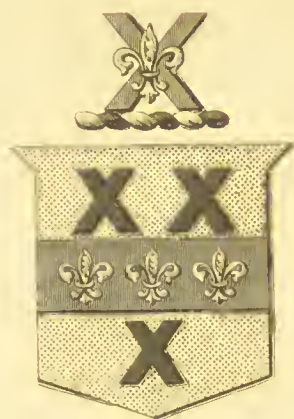




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# CONTENTS.

---

|                                                               | <i>Page.</i> |
|---------------------------------------------------------------|--------------|
| DESCENDING AORTA, . . . . .                                   | 1            |
| THORACIC AORTA, . . . . .                                     | 2            |
| Bronchial Arteries, . . . . .                                 | 6            |
| Œsophageal Arteries, . . . . .                                | 10           |
| Intercostal Arteries, . . . . .                               | 11           |
| ABDOMINAL AORTA, . . . . .                                    | 19           |
| Operation of tying the Abdominal Aorta, . . . . .             | 26           |
| Cœliac Axis, . . . . .                                        | 30           |
| Gastric Artery, . . . . .                                     | 31           |
| Hepatic Artery, . . . . .                                     | 32           |
| Splenic Artery, . . . . .                                     | 37           |
| General Remarks on the branches of the Cœliac Axis, . . . . . | 42           |
| Superior Mesenteric Artery, . . . . .                         | 45           |
| Inferior Mesenteric Artery . . . . .                          | 50           |
| General Remarks on the Mesenteric Arteries, . . . . .         | 53           |
| Phrenic Arteries, . . . . .                                   | 56           |
| Capsular or Atrabiliary Arteries, . . . . .                   | 58           |
| Renal or Emulgent Arteries, . . . . .                         | ib.          |
| Spermatic Arteries, . . . . .                                 | 60           |
| Remarks on the Operation of Castration . . . . .              | 62           |
| Lumbar Arteries, . . . . .                                    | 65           |
| Middle Sacral Artery, . . . . .                               | 67           |
| COMMON ILIAC ARTERIES, . . . . .                              | 68           |
| INTERNAL ILIAC OR HYPOGASTRIC OR UMBILICAL ARTERY, . . . . .  | 70           |
| Operation of tying the internal Iliac Artery, . . . . .       | 73           |

|                                                         | <i>Page.</i> |
|---------------------------------------------------------|--------------|
| Ilio-lumbar Artery, . . . . .                           | 78           |
| Lateral Sacral Artery, . . . . .                        | 80           |
| Middle Hæmorrhoidal Artery, . . . . .                   | 81           |
| Vesical Arteries, . . . . .                             | 82           |
| Umbilical Artery, . . . . .                             | 83           |
| Uterine Artery, . . . . .                               | 84           |
| Vaginal Artery, . . . . .                               | 85           |
| Thyroid or Obturator Artery, . . . . .                  | ib.          |
| Remarks on Femoral Hernia, . . . . .                    | 89           |
| Gluteal Artery, . . . . .                               | 90           |
| Operation of tying the Gluteal Artery, . . . . .        | 95           |
| Ischiadic Artery, . . . . .                             | 96           |
| Operation of tying the Ischiadic Artery, . . . . .      | 99           |
| Internal Pudic Artery, . . . . .                        | 100          |
| External Hæmorrhoidal Arteries, . . . . .               | 109          |
| Perinæal Artery, . . . . .                              | 110          |
| Transverse Perinæal Artery, . . . . .                   | 111          |
| Artery of the Corpus Spongiosum Urethræ, . . . . .      | 112          |
| Observations on Lithotomy, . . . . .                    | ib.          |
| Artery of the Corpus Cavernosum Penis, . . . . .        | 115          |
| Dorsal Artery of the Penis, . . . . .                   | ib.          |
| EXTERNAL ILIAC ARTERY, . . . . .                        | 119          |
| Epigastric Artery, . . . . .                            | 122          |
| Observations on Inguinal Hernia, . . . . .              | 125          |
| Circumflex Ilii Artery, . . . . .                       | 126          |
| Operation of tying the external Iliac Artery, . . . . . | 129          |
| FEMORAL ARTERY, . . . . .                               | 133          |
| Superficial Epigastric Artery, . . . . .                | 142          |
| Superficial or external Pudic Arteries, . . . . .       | 143          |
| Superficial Circumflex Ilii Artery, . . . . .           | 144          |
| Arteria Profunda Femoris, . . . . .                     | ib.          |
| External Circumflex Artery, . . . . .                   | 147          |
| Internal Circumflex Artery, . . . . .                   | 149          |
| First Perforating Artery, . . . . .                     | 152          |
| Second Perforating Artery, . . . . .                    | ib.          |

# CONTENTS.

v

*Page.*

|                                                                                |     |
|--------------------------------------------------------------------------------|-----|
| Third Perforating Artery, . . . . .                                            | 153 |
| Anastomotica Magna, . . . . .                                                  | 155 |
| Operation of tying the Femoral Artery, . . . . .                               | 156 |
| POPLITEAL ARTERY, . . . . .                                                    | 167 |
| Operation of tying the Popliteal Artery, . . . . .                             | 173 |
| POSTERIOR TIBIAL ARTERY, . . . . .                                             | 177 |
| Peronæal Artery, . . . . .                                                     | 179 |
| Operation of tying the posterior Tibial Artery, . . . . .                      | 182 |
| Internal Plantar Artery, . . . . .                                             | 188 |
| External Plantar Artery, . . . . .                                             | ib. |
| ANTERIOR TIBIAL ARTERY, . . . . .                                              | 193 |
| Recurrent Branch, . . . . .                                                    | 195 |
| Malleolar Arteries, . . . . .                                                  | 196 |
| Tarsal Artery, . . . . .                                                       | 197 |
| Metatarsal Artery, . . . . .                                                   | ib. |
| Operation of tying the anterior Tibial Artery, . . . . .                       | 193 |
| General Observations on the Arteries of the inferior Ex-<br>tremity, . . . . . | 200 |





*Alexander Currie*

SURGICAL ANATOMY

OF THE

ARTERIES.

---

AORTA DESCENDENS.

THE aorta, from the termination of its arch, descends along the left side of the dorsal vertebræ to the diaphragm, between the crura of which it passes into the abdomen, and descending as low as the fourth or fifth lumbar vertebra, it divides into the right and left iliac arteries.

The course of this vessel from the fourth dorsal to the fourth lumbar vertebra is not in a straight line, but is very much curved, the convexity to the right, the concavity to the left side; in the upper part of the thorax the artery lies to the left side of the spine; on the twelfth dorsal vertebra it is nearly in the mesial line, while on the lumbar vertebræ it inclines a little to the left side. The descending aorta is also concave forwards in the thorax, and convex forwards in the abdomen, being thus accommodated to the form

of the anterior surface of the spinal column, to which it is applied.

The passage of the aorta through the diaphragm affords a good opportunity for dividing this vessel into two parts, viz. the superior or thoracic, and the inferior or abdominal portion; the latter is shorter and smaller than the former. It is immaterial to which of these the dissector first directs his attention.

#### AORTA THORACICA.

To expose the thoracic aorta, the student should lay open the cavity of the thorax, at least on the left side; the sternum and costal cartilages having been removed, the ribs of this side must be divided with the saw, near to, or behind their centre, (a block being placed beneath the dorsal vertebræ,) the pericardium, heart, and left lung, are then to be drawn over to the right side, and thus the posterior mediastinum will be exposed, in which region the aorta and œsophagus may be discerned through the pleura.

The posterior mediastinum is described in anatomical writings as a space of a triangular figure, extending from the third to the tenth dorsal vertebra, the sides of this space formed by the two pleuræ, the base by the vertebræ, and the apex by the approximation of the pleuræ on the posterior surface of the pericardium, and by this membrane also. This description is too mechanical, the posterior mediastinum has no very accurate form, the serous membranes are not tense along its sides, as they appear to be when the

lungs are drawn forwards, but each pleura is folded upon the organs in front of the vertebræ, so that the aorta is nearly enveloped by these membranes, which approach each other in front of it, and behind the œsophagus, almost surrounding that tube also, with which however they are more loosely connected than with the aorta. In this region are contained the œsophagus and aorta, the vagi and splanchnic nerves, (the sympathetic nerves are not properly in this space,) the thoracic duct, vena azygos, several lymphatic glands, and a considerable quantity of cellular membrane.

As the student proceeds in exposing the thoracic aorta, he will find that this vessel is covered by the left pleura through its whole course, and that the left bronchial tube, the root of the left lung, the left auricle of the heart, and the pericardium, are all anterior to it. The œsophagus, with its accompanying nerves, (the vagi), crosses the aorta obliquely, for the former in its descent inclines from the mesial line to the left side, whereas the aorta advances from the left to the front of the spinal column; accordingly, in the upper part of the posterior mediastinum, the œsophagus is on the right side of the aorta, between it and the right pleura: in the middle division of this region it is in front of the artery, between it and the pericardium: and inferiorly it is to its left side but on a plane anterior to it.

The thoracic aorta lies very near the vertebral column, separated from it only by some cellular membrane, by the commencement of the intercostal arte-

ries, and by the intercostal veins of the left side, in their course to join the vena azygos. The splanchnic nerves are on each side of the aorta; that on the left side is close to it, and frequently passes through the diaphragm by the same opening as the artery, or separated from it only by a few fibres of the muscle.

The anomalies which have been observed in this portion of the arterial system, have been already noticed in the commencement of the first part of this work.

Before the student proceeds to examine the branches of the thoracic aorta, he should reflect on the effects which disease of this part of the arterial system is likely to produce on the surrounding parts. We know that aneurism may form in any part of the thoracic aorta, and we may expect, that, in consequence of the great distance of the artery from the surface, and its contiguity to several organs, the symptoms of this disease shall be sometimes very obscure, and liable to be mistaken for those of other affections. Aneurism of the thoracic aorta may extend into the posterior mediastinum, press against the œsophagus, and cause pain and difficulty in swallowing, as in stricture of that tube; or by pushing forward the heart, it may give rise to symptoms resembling those attending some of the diseases of that organ; the aneurismal sac may be directed backwards towards the vertebræ, and induce absorption or caries of their bodies and curvature, with pain and weakness of the spine and extremities; while the tumour protruding the integuments on either side of the

spine, may assume the appearance of an abscess connected with diseased bone. If the disease incline to either side, it may press upon the lung, produce irritation and pain in that organ, pain in the side and difficult respiration, with frequent cough, so as to resemble phthisis: in many cases, however, the expectoration in these diseases differs essentially, being thin and frothy in cases of aneurism, and viscid mucus, or purulent, in diseased lungs.

Aneurism of the thoracic aorta may burst into the lung, into the cellular membrane in the posterior mediastinum, into the œsophagus, or into the cavity of the pleura, particularly into that of the left side: it will open into the mediastinum or œsophagus by the process of sloughing; but when the pleura becomes stretched over the aneurismal sac, that membrane tears or cracks suddenly. Sometimes an aneurismal tumour which has formed at the upper part of the thoracic aorta, will dissect its way down for some distance along the vessel between its cellular and middle coats, and may then burst into the mediastinum, or again form a communication with the cavity of the artery.

From the thoracic aorta several branches proceed, which, however, are so small, that when this trunk has arrived at the diaphragm it is not sensibly diminished in magnitude; some of these branches supply the viscera, others the parietes of the thorax. The branches of the thoracic aorta, though not remarkable for their size, are yet worthy of notice; they may be divided into two orders, namely, those arising

from the front and those from the back of the aorta; the former are the bronchial and œsophageal, also small branches to the pericardium and posterior mediastinum: the latter are the intercostal arteries.

The student should dissect the anterior branches first; those to the pericardium and mediastinum are so insignificant in size, and so uncertain as to their origin, or even as to their existence, as not to require any particular description.

#### ARTERIE BRONCHIALES.

THE bronchial arteries are generally believed to be the nutritious arteries of the lungs; they receive their name from the bronchial tubes which they accompany through these organs; in number and in magnitude they are very irregular, as well as in the situation of their origin; some anatomists enumerate four, and others only two. They may be distinguished by the names of the superior and inferior, right and left bronchial arteries.

These four arteries arise from the aorta, sometimes distinctly, and sometimes by two or three, or even by one common trunk.

The *superior bronchial arteries* arise either in common or separately from the anterior part of the aorta, opposite the fifth or sixth dorsal vertebra; (the superior bronchial of the right side often arises from the first intercostal artery;) they soon separate, and pass towards either lung, giving off small branches to the left auricle of the heart, to the pericardium, the bron-



chial glands, œsophagus, and cellular membrane in the posterior mediastinum. These arteries then attach themselves to the posterior surface of the bronchial tubes, and twining round these vessels, accompany them into each lung, where they divide into four or five branches, which soon subdivide into numerous ramifications, to supply the bronchial tubes and the cellular tissue of the lungs.

The *inferior bronchial artery* or *arteries* arise a little lower down than the last, and are distributed in a similar manner; they are usually larger than the superior. The bronchial tubes frequently receive additional arteries from the internal mammary or from the subclavian arteries.

The minute branches of the bronchial arteries are thought, by some anatomists, to inosculate with those of the pulmonary artery; the anastomosis between these vessels is delineated by Ruysch and Cowper, as being very distinct and free; this communication is the more remarkable, as these arteries are supposed to differ not only in their functions, but also in the qualities of the blood which each contains, it being bright red or arterial in the bronchial, but dark purple or venous in the pulmonary arteries.

Some anatomists have asserted that the bronchial arteries communicate with the pulmonary veins; such an anastomosis appears a remarkable exception to the general laws of the circulation, which require that all the blood should pass through the pulmonary circulation before it enters the aorta; but if the communication just alluded to exist, a quantity of blood must be

returned from the bronchial arteries, by the pulmonary veins, to the left side of the heart, without having previously passed through the pulmonary artery.

Winslow has observed one of the bronchial arteries to terminate in the vena azygos, (*Anatomie du Corps humain*, sect. iv. p. 113.) Portal, with the right coronary vein of the heart, (*Cours d'Anatomie Medicale*, tom. III. p. 254.)

In the *Journal de Medicine*, (*Pluviose*, an. 10.) a case is recorded of a large artery arising from the abdominal aorta, near the cœliac axis, and entering the thorax by the side of the œsophagus, it then divided into two branches, one to supply the inferior lobe of each lung; in the substance of which its branches anastomosed freely with the superior pulmonary arteries. The pulmonary veins were regular. This singular case ought perhaps to be considered rather as an irregularity in the pulmonary artery, which only supplied the superior lobes of the lung, than in the bronchial arteries, although the anomalous vessel arose from the aorta.

I have injected the bronchial arteries in several subjects; in some few cases, where the fluid was very fine, it entered the pulmonary arteries; I have never been able, however, to see the inosculating branches, as delineated by Ruysch, nor could I affirm whether the injected fluid passed through continuous tubes, or whether the communication between these vessels had not been opened by a rupture of both. I have never been able to inject the bronchial arteries from the pulmonary artery, the fluid has in every instance returned

by the pulmonary veins, and if much force had been used, it has entered the air tubes.

Although I have never succeeded in filling the bronchial veins from the bronchial arteries, yet, judging from analogy, I think there can be no doubt of a communication existing between these vessels. When I reflect on the small size of the bronchial arteries, compared with the organs they supply, as well as their irregularity in situation and in origin, I cannot altogether concur in the opinion that these are the only nutritious vessels which the lungs possess; this is a subject which cannot be decided by any accurate or unobjectionable experiment; yet, it does not appear to me why the pulmonary artery may not convey blood to the lungs for the double purpose of its purification, and for their supply; that one artery can accomplish the twofold office of secretion and of nutrition may be inferred from observation of different glands, as the kidney and testicle: in each of these organs one artery must effect both processes; and in the skin, which performs a function very similar to that of the lungs, we have every reason to believe that the ramifications of the same arteries not only nourish this tissue, but also secrete or exhale the peculiar fluid of perspiration. It is objected to the pulmonary artery having the property of supporting the lungs, that it conveys venous blood, which in no other tissue is supposed to possess the qualities necessary for nutrition; to this, however, we may reply, that the blood in the pulmonary artery, though of venous colour, has just received the chyle, that material on which the nourishment and repairs of

the whole system must depend. Neither is there any proof that the vena porta is merely a vessel for secretion.

When the pulmonary artery is injected minutely, the whole lung, particularly the mucous membrane lining the bronchial cells and vessels, is deeply tinged with the coloured fluid; not so if the bronchial arteries be injected, they in general do not admit a sufficient quantity of the injection, to alter the colour of the lung, unless the fluid shall have passed into the branches of the pulmonary artery, and then the same effects will be produced as if the fluid had been forced from the trunk of that vessel itself. The bronchial arteries are not found enlarged in cases of long continued inflammation, which has condensed or altered the structure of the lung, or of its serous membrane, or produced adhesions between the pleura pulmonaris and costalis; and in such cases the parts so affected, as well as any new membrane which may have been formed by the adhesive process, can be injected from the pulmonary artery.

#### ARTERIÆ ŒSOPHAGÆÆ

ARE uncertain in number, size, and situation; sometimes there is but one, and that of considerable size; sometimes several small arteries arise from the aorta distinctly, and sometimes they are all derived from the bronchial arteries; the Œsophageal arteries ramify on the muscular parietes of the Œsophagus, and on the surrounding cellular membrane: some branches as-

cent, and inosculate with the inferior thyroid arteries; others descend towards the diaphragm, and join with branches from the phrenic and gastric arteries. The arteries of the œsophagus are principally distributed along with the branches of the surrounding plexus of nerves to the muscular, and not to the mucous coat of the œsophagus; accordingly the lining membrane here is not so vascular or sensible as in other parts of the digestive canal. On the parietes of the œsophagus, the student may trace a chain of communication between the arteries of the neck, thorax, and abdomen, the links of which are the thyroid branches of the carotid and subclavian arteries, and the œsophageal and gastric branches of the thoracic and abdominal aorta. Winslow has observed a communication between one of the œsophageal arteries and one of the pulmonary veins.

#### ARTERIE INTERCOSTALES.

THE aortic intercostal arteries are generally nine in number on each side; there are sometimes ten, and sometimes only eight; this variety depends on the size of the superior intercostal arteries, which may supply one or three intercostal spaces; not unfrequently there are ten aortic intercostals on the left, and only eight on the right side. Sometimes two or three intercostal arteries of one side will arise by a common trunk, this is more frequently observed in the inferior portion of the series, and is analogous to the

arrangement in the two or three first intercostal spaces.

All these arteries are so nearly similar in their origin, course, and termination, that one description may apply to all. The student should select one or two of the largest, and by making a careful dissection of these, he may acquire a sufficiently accurate knowledge of the whole class.

The intercostal arteries take their origin from the posterior part of the aorta, those of opposite sides arise very near each other, sometimes by a common trunk: each artery then ascends obliquely, passing at the same time backwards and outwards, in a groove on the side of each vertebra, and arriving at the intercostal space, it divides into a posterior and anterior branch. The superior aortic intercostal arteries ascend very obliquely, the middle less so, and the two or three inferior are nearly transverse. There is no essential difference between the intercostal arteries of the right side, and those of the left; the former are somewhat longer, and cross the spine behind the vena azygos and thoracic duct. The intercostal arteries of each side are covered by the pleura, and they all pass behind the sympathetic nerve and its ganglions. As the intercostal arteries pass by the sides of the bodies of the vertebræ, they send several branches to these bones and to the parts in the posterior mediastinum; at the head of every rib each artery sends off ascending and descending branches, which inosculate with corresponding branches from the artery above and below; in like manner, the first aortic intercostal anas-



tomoses with the superior intercostal from the subclavian artery, thus preserving a communication between the arteries of the neck and those of the thorax.

If the aorta were obliterated at the inferior extremity of its arch, this anastomosis would assist in conveying blood from the subclavian artery into the descending aorta. A case in which this actually occurred is recorded in the 5th vol. of the *Med. Chir. Transactions*.\* The posterior branch of each intercostal artery is smaller than the anterior, it escapes from the thorax through an opening which is bounded internally by the vertebræ, and externally by the costo-transverse ligament; it first gives off two or three branches, which enter the spinal canal by the intervertebral foramen; these assist in supplying the vertebræ, the spinal marrow, and its membranes; the posterior branch having arrived in the fossa between the spinous and transverse processes of the vertebræ, divides into a great number of branches; some are very short and are distributed to the sacrolumbalis, longissimus and spinalis dorsi muscles; others are very long and pass towards the scapula, supplying the trapezius, latissimus dorsi, and rhomboid muscles and the integuments, and they ultimately anastomose with different arteries at the base of the scapula.

The anterior branch of each intercostal artery is much larger than the posterior, appears to be the continued trunk, and is the proper intercostal vessel.

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\* A similar case is recorded by Dessault: (*Journal*, 1789.) See also Guthrie on Diseases and Injuries of Arteries, p. 354.



Each of these arteries passes upwards and outwards, and, near the angle of the rib enters the groove in its inferior edge, and is thus conducted round the parietes of the thorax, between the laminæ of the intercostal muscles and at the upper part of each intercostal space ; in this course the artery lies close to the bone, and much nearer to the pleura than to the integuments ; the student may expose it either from within, by raising off the pleura, or from without, by dividing the different muscles which occupy the intercostal space.

Each intercostal artery is accompanied by a nerve of considerable size, and by one or two veins which lie superior to the artery. As the artery proceeds, it gives several branches to the intercostal muscles and to the pleura, also to the muscles on the parietes of the thorax ; some of these branches anastomose with the thoracic arteries, particularly in the axilla : about the centre of the rib the artery usually divides into two branches, an inferior small one runs along the superior margin of the inferior rib, and supplying the intercostal muscles is lost on the external surface of the rib ; the other, or superior branch continues in its original direction along the superior rib as far as its cartilage, and there descending a little, it meets a branch from the mammary artery. The inferior intercostal arteries send branches to the crura of the diaphragm, to the quadratus lumborum, and to the abdominal muscles ; these arteries anastomose with the phrenic, lumbar, and epigastric.

If the student have an opportunity of dissecting the

arteries of the thorax in a very well injected young subject, he will find numerous anastomoses to exist in the parietes of this cavity; at each side of the spine the posterior branches of the intercostal arteries communicate freely with each other, and with descending branches from the cervical arteries, with the arteries about the scapula, and with the posterior branches of the lumbar arteries. On the sides of the thorax, the intercostal vessels have free and frequent inosculations with the thoracic branches of the axillary artery, and anteriorly each intercostal is joined by a branch of the mammary.

A considerable quantity of blood must circulate in the parietes of the thorax, and branches from the same arteries supply the integuments, muscles, and serous membranes; this may account for the sympathy between the integuments of the thorax and its lining membranes, as is exemplified in the effects of cold, which, when applied to the surface, often excites irritation and disease in the pleura, while again local bleeding, blisters or any other counter-irritants are among the most certain means of relief in cases of internal inflammation.

The intercostal arteries may be wounded by a spicula of a fractured rib, or in cases of wounds which penetrate the cavity of the thorax; also in the operation of paracentesis of the thorax, or in opening an hepatic abscess which points at an intercostal space. In case of a wound of the thorax, in which an intercostal artery has been opened, the patient may lose a considerable quantity of blood before the surgeon can

stop the hæmorrhage, the artery lies so deep, and the intercostal space is so confined, that it is almost impossible to hold the artery with the tenaculum or forceps, for the purpose of applying a ligature upon it. The student may form some conception of the difficulty of this operation, if he expose an intercostal artery in the dead subject by dissecting from the surface; this may also lead him to reflect on the plans which have been proposed for securing this vessel, when a ligature cannot be directly applied; he may endeavour to pass a small curved needle round the artery, directing it from within outwards: and should this measure be attended with much difficulty, from the smallness of the incision, he may observe how much it will be facilitated by enlarging the opening. Suppose it were impracticable to pass a ligature round the artery in the living subject, he may from this dissection learn the possibility of compressing it, by introducing a piece of sponge, with ligatures attached to it, into the thorax, and by drawing these outwardly, press the vessel against the bone; graduated compresses may be then applied over these, and the ligatures secured externally round a quill or bougie or by adhesive plaster; this plan I think will appear preferable to that of passing a ligature or wire round the rib, and so including not only the artery, but also the bone, and different soft parts. The proposal also of applying and securing metal or ivory plates on such a moveable part as the rib, appears objectionable as the attempt must be attended with considerable difficulty and inconvenience.

Where the surgeon is required to open any of the intercostal spaces, either in case of empyema or abscess of the liver pointing between the ribs, he should be particularly careful to avoid injuring the intercostal artery, or any of its large branches; the trunk of the artery is easily avoided by directing the flat trochar or lancet towards the inferior rib; but there is considerable difficulty in avoiding the branches which in these chronic diseases are often increased in size. If the operation be performed with the trochar, this instrument may only wound these vessels; or should it completely divide them, they may retract beneath the muscles, and bleed but little at the time of the operation; but when the patient has recovered from the first effects of the operation, and has become warm in bed or if he make any exertion, he is soon overcome with fainting and an alarming sense of weakness, yet no blood appears through the dressing, because it more readily flows into the cavity of the abscess where there is free space to receive it; this tendency to hæmorrhage may continue, and will return on the slightest exertion; and thus, in a very few days reduce the patient's strength to the last extremity. Hæmorrhage in such cases is very distressing and alarming; it is often impossible, when the wound is re-opened to see any particular vessel; and the parts are so tender and irritable from previous distention and disease, that compression or styptics are almost insupportable; and although they may for a time command the hæmorrhage, yet they will soon be followed by sloughing and fresh bleeding which will exhaust

and destroy the patient. In performing the operation in the first instance, the surgeon should not only divide the integuments with the knife, but also cautiously dissect through each layer of muscles, until the pleura or the wall of the abscess be distinctly seen or felt, and should any vessels be divided in this stage of the operation, they should be secured before the sac is opened, which may be done either with a lancet or with a flat trochar, which is much to be preferred to one of a triangular figure.

## AORTA ABDOMINALIS.

To expose this artery, the abdominal muscles and peritoneum must be divided from the sternum to the pubes, and from the umbilicus to each os ilium; the three last ribs on either side may be sawed through about their centre, and everted; this will admit of the epigastric region being fully expanded, and of the viscera being separated from each other; a block should be placed beneath the last dorsal vertebræ. The less the peritoneum and its different duplicatures are injured, the better view will the student obtain of the relative anatomy of the aorta and of its branches; most of which can be exposed by dividing one lamina only of the processes of that membrane, and by moving the viscera in such directions as their loose connexions will permit; first divide the lesser omentum, but avoid injuring the gastric arteries, draw down the stomach towards the left side and then, by dissecting through some cellular membrane and nerves, the commencement of the abdominal aorta and the origin of some of its principal branches may be exposed; next, raise the stomach and great omentum (having first separated the latter from the colon) towards the chest, and the cavity of the epiploon being thus opened, dissect through the ascending layer of the mesocolon, this will expose the pancreas and duodenum; and by separating these, the aorta will be again seen; lastly, by elevating the transverse colon and mesocolon to-



wards the thorax, and by drawing down the mesentery towards the right side, the continuation of the aorta may be discerned through the peritoneum, which is stretched over it in a very tense manner, and by dividing this the artery will be perfectly exposed even to its division.

The aorta extends nearly in a straight line from the opening between the crura of the diaphragm to the fourth or fifth lumbar vertebra, where it divides into the right and left iliac arteries; behind the lesser omentum it lies in the mesial line, but as it descends it inclines a little to the left side; it rests upon the bodies of the lumbar vertebræ and is therefore convex forwards, its greatest convexity is on the third vertebra, that is a little superior and to the left side, of the umbilicus.

The abdominal aorta is covered by the following parts: first, by the lesser omentum and stomach, behind which are the branches of the cœliac axis of arteries, and the solar plexus of nerves; opposite the upper edge of the second lumbar vertebra, the artery is covered by the vena porta and mesenteric vessels, in front of which is the pancreas; inferior to these the duodenum passes across the aorta, separated from it by the left emulgent vein; (this vein in a few instances I have seen pass behind the aorta;) inferior to the duodenum the aorta is covered by the transverse mesocolon, and then by the root of the mesentery; and from this to its division it is covered by one lamina only of the peritoneum, and by the convolutions of the small intestines.



The aorta does not descend abruptly from the thorax into the abdomen through a well defined opening in the diaphragm ; on the contrary, it passes gradually behind the crura of that muscle, close to the vertebræ and is contained in a tendinous canal, about an inch in length, in which situation the artery (accurately speaking) is neither in the thorax or abdomen, but behind and between both cavities. This opening for the passage of the aorta is of a semilunar form, its edges are tendinous, so that the action of the muscle cannot affect the vessel ; it is bounded laterally by the crura of the diaphragm, superiorly and anteriorly, by their connecting fibres and posteriorly by the last dorsal vertebra, which is covered by a ligamentous substance partly derived from the tendons of each crus turning in a little behind the artery : this opening is much larger than the aorta, and contains a quantity of cellular membrane, which connects the peritoneum and pleura to each other. The thoracic duct also and vena azygos pass through this opening, and lie between the aorta and the right crus of the diaphragm.

The œsophageal opening in the diaphragm, (the edges of which are muscular,) is to the left side of that for the aorta, and on a plane anterior and superior to it, the cardiac orifice of the stomach being opposite the left side of the ninth or tenth dorsal vertebra ; these openings are separated by the decussating fibres which pass from one crus of the diaphragm to the other.

The large tendinous opening in the diaphragm for the passage of the vena cava, is to the right side and

anterior to that for the aorta, it is opposite to the right side of the tenth dorsal vertebra. The splanchnic nerves, expanding into the semilunar ganglions, lie on either side of the aorta as it enters the abdomen; the ganglion of the left side passes somewhat in front of this vessel, and is united to that of the right side by numerous nerves, which form the solar plexus: this plexus covers the aorta and surrounds the cœliac axis, and its branches accompany those of the aorta.

The abdominal aorta is accompanied by the vena cava, which lies to its right side is in contact with and partly covers it from the fifth to the second lumbar vertebra; the vein is then separated from the artery by the right crus of the diaphragm, and by the middle or spigelian lobe of the liver.\*

The sympathetic nerves run parallel to the abdominal aorta, that of the left side is much nearer to the artery than the right, they are both, however, separated from it superiorly by the crura of the diaphragm, between which and the psoas magnus they are im-

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\* In the dissecting room, I lately met with a singular deviation from this (the usual course) of the vena cava; the subject was an old female; in it the two iliac veins united on the left side of the aorta on the fifth lumbar vertebra, the vena cava thence ascended on the left side of the artery; and opposite to the second vertebra, the vein was very much dilated, and passed over the aorta to its right side, and then entered as usual the groove in the right lobe of the liver; the femoral and iliac vein of the left side lay on the iliac side of their accompanying artery. I made a preparation of this singular variety, and have placed it in the museum of the School of Surgery.

bedded ; the thoracic duct lies to the right side of the aorta above, but the commencement of this canal in the receptaculum chyli, is on the third or fourth vertebra behind the artery.

Before the student proceeds to a minute examination of the branches of the abdominal aorta, he should again consider the relation which this artery bears to the numerous viscera of the abdomen, the depth at which they lie from the surface, as well as the thickness and nature of the parts through which, in cases of disease, an examination in the living body is to be made. If we reflect a little on these circumstances, we shall be able to account for the difficulty that is often experienced in discriminating between aneurism of any of the principal arteries in the abdomen, and organic disease of any viscus in their vicinity. Aneurism is often found to occur in the abdominal aorta near the cœliac axis, sometimes in this short trunk itself or in one of its branches ; and sometimes in the superior mesenteric artery. Suppose this disease exists in any of these vessels the stomach will suffer more or less inconvenience, slight perhaps at first, as in ordinary dyspepsia, but in proportion as the tumour increases in size, the functions of this organ will become more deranged and sickness and vomiting will be induced whenever it is distended by food ; the situation and extent of this viscus and the great distance of the aorta from the surface in this part of the abdomen render it, in some cases almost impossible by an examination even the most careful, to decide on the exact nature of the disease. The pulsation is some-

times diffused, and appears to effect the whole epigastric region, as in some cases of flatulence and dyspepsia in very nervous or hypochondriac habits, where there is no disease in the arterial system. I may observe, however, that aneurism may in general be distinguished from that pulsation, which is often so remarkable in these constitutions; the pulsation in aneurism is strong and regular, synchronous with the pulse, and made more distinct by pressure; the pulsation in dyspepsia is irregular and unequal, is increased at one time, and is almost imperceptible at another; it is not synchronous with the pulse, but has more of a fluttering motion; when strong pressure is made upon the part affected, the pulsation soon ceases, nor does it immediately recur on removing that pressure; neither does the pulsation always return exactly in the same place.

Aneurism in any of the situations just mentioned, may burst into the stomach or duodenum, into the cellular membrane about the spine, into the cavity of the peritoneum, or between the laminæ of any of its processes. If the pyloric extremity of the stomach be enlarged, and connected by adhesive inflammation to the parts behind it, the pulsation of the aorta may be communicated to it, and may so give rise to symptoms resembling aneurism; in like manner diseased pancreas, tumours in the omentum or mesentery, or enlarged lymphatic glands, may have a pulsation communicated to them from this large artery as it rests against the spine, and this pulsation be perceptible through the abdominal parietes.

Having considered the several relations of this artery to the viscera in the abdomen, the student cannot fail to remark that, in making an examination of the living body, to ascertain the exact nature or situation of any disease, the position of the patient should be particularly attended to; that it will be necessary to have the abdominal muscles relaxed, and that by changing the posture of the patient from the horizontal to the sitting or erect or even bent forward or inclined to one side, he may be enabled to ascertain whether the pulsation of the tumour is diminished or increased by these changes of position; whether it is circumscribed, or confined to the line of the artery, or diffused according to the form of any particular viscus; whether the pulsation be synchronous with the pulse at the wrist, or rather an undulatory motion, synchronous with inspiration and expiration, as is sometimes observable in the vena cava below the liver, in diseases of that organ, or in nervous temperaments.

Aneurism of the abdominal aorta sometimes arises from the back part of the artery, and extends laterally and posteriorly towards the psoas muscle, and as it increases in size, it causes the absorption of this muscle and of the lumbar vertebræ; it then may press on the lumbar plexus of nerves, and cause weakness and paralysis of the lower extremities, and pain in the loins, as in psoas abscess; the tumour may also protrude backwards, and resemble an abscess connected with diseased bone.\*

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\* I recollect a remarkable case of this kind which occurred many years since, and which I had an opportunity of examining



In very thin persons, if the abdominal muscles be relaxed, the aorta may be felt pulsating a little above, and to the left side of the umbilicus ; in wounds of the abdomen, in which the aorta or common iliac artery has been injured, or in case of hæmorrhage from the bursting of an iliac aneurism, life may be suspended by making strong and steady compression on this part of the artery ; and we can conceive a case in which a surgeon would be justified, even in opening the abdomen, and passing a ligature round the aorta itself. *Sir A. Cooper* has related a case of hæmorrhage, caused by the sloughing of a large aneurism of the left external iliac artery, in which he performed this operation, and which had the desired effect of protracting life for a period of forty hours ; in this singular case, we find too, that the circulation was maintained in the lower extremity of the opposite side, although the main artery was obliterated. The abdominal aorta has been also tied, but with the same result, by *Mr. James of Exeter*, in a case of unsuccessful operation on the internal iliac artery.

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after death ; in was in *St. Thomas's Hospital*, under the care of my much esteemed friend, *Mr. Travers* ; the patient had most of the symptoms of psoas abscess, a fulness was perceptible in the lower part of the right side of the abdomen, a tumour was also observed posteriorly at the right side of the spine ; there was no pulsation in it that could be perceived through the parietes of the abdomen ; the patient had suffered from it for more than four years, and yet there was but little swelling or distention in any direction ; dissection shewed it to be an aneurism of the abdominal aorta, while it thus had greatly the appearance of psoas abscess during life.

Although we can scarcely hope for success from an operation so formidable in execution, and hazardous in its consequences, as that of tying the abdominal aorta; yet, when we consider that by it we may be enabled to avert immediate dissolution, and so perhaps secure incalculable benefit to the sufferer or his friends, we may justly regard this bold attempt of modern surgery, as worthy the attention of the surgical anatomist. In both cases of this operation above alluded to, the peritoneum was opened, in order to expose the aorta; as however it appears that a ligature may be placed upon this vessel by the same steps as are pursued in tying the external and the common iliac arteries, I shall defer any further remarks upon this subject, until I come to speak of the surgical anatomy of those vessels.

From the abdominal aorta several branches arise; they supply the diaphragm, the liver, spleen, pancreas, and all the alimentary canal, also the kidneys, testes, or ovaria, and the posterior and lateral parietes of the abdomen. The student may arrange these branches into two sets, namely, those from the anterior and those from the posterior part of the aorta; the former are nine in number four of which arise in the epigastric region, and five in the lumbar; those which arise in the epigastric region, are the two phrenic arteries, the cœliac axis, and superior mesenteric. The phrenic arteries supply the diaphragm; the cœliac axis supplies the great viscera in this region, viz., the liver, spleen, and stomach; the superior mesenteric is distributed to all the small intestines except the duode-



num, and to all the large intestines except the left descending colon and rectum. The branches which arise from the aorta in the lumbar region are the two renal arteries, the two spermatic arteries, and the inferior mesenteric artery. The renal arteries supply the kidneys, and their appendices the renal capsules; frequently small branches, named the capsular arteries, arise from the aorta, some above, and some below the renal artery; the former supply the renal capsules, the latter the ureters and surrounding cellular membrane; the spermatic arteries supply the testes or the ovaria; and the inferior mesenteric artery supplies the left descending colon, the sigmoid flexure and the rectum. The posterior set of branches of the aorta, are the four or five pair of lumbar arteries which supply the muscles of the posterior and lateral regions of the abdomen; and the middle sacral artery, which is distributed to the ligaments and muscles on the anterior surface of the sacrum.

The branches of the abdominal aorta are extremely irregular in their number and in the situation of their origin; the following is the order in which they most frequently arise, and may be considered the regular order, if such a term can properly be applied to a series of branches which present greater varieties in every respect than any other arteries in the body. The phrenic arteries are the first; the cœliac axis arises next; immediately below which is the superior mesenteric; about half an inch lower down are the renal arteries; and immediately below these are the spermatic; about an inch and a half or two inches be-

low the renal, and about half an inch above the division of the aorta, the inferior mesenteric artery arises ; the lumbar arteries proceed from the back of the aorta, opposite each lumbar vertebra, and the middle sacral arises also from its posterior part, about a quarter of an inch above its division. I shall mention the most common deviations from this order in describing the individual arteries.

Thus the abdominal aorta, like the thoracic, supplies the parietes of the cavity through which it passes, as well as the viscera which that cavity contains ; in the thorax, however, the branches to the parietes are many and large, and those to the viscera small and few, whereas in the abdomen, the visceral branches are large and numerous, but those to the parietes are inconsiderable.

I do not recommend the student to trace the branches of the aorta according to the order in which they arise, or as I have arranged them above ; he had better first examine the three great vessels (*viz.*, the celiac axis, the superior and the inferior mesenteric arteries) which supply all the digestive organs : having done so, the viscera may be removed and the other branches of the aorta can then be more satisfactorily exposed. It also appears more natural to connect the description of these arteries which are so closely united in their functions, being distributed to one class of organs and being remarkable for their free communications with each other, from the cardiac orifice of the stomach to the rectum.

In the following description, therefore, I shall consider these three arteries first :

## I.

## ARTERIA VEL AXIS CÆLIACA.

THIS artery may be exposed by dividing the anterior layer of the lesser omentum near the cardiac orifice of the stomach, and separating some cellular membrane and nerves which cover the aorta.

The cœliac axis arises opposite the lower margin of the last dorsal vertebra, immediately below the aortic opening in the diaphragm, and above the pancreas and vena porta: the lobulus Spigelii is to its right side, the renal capsules and semilunar ganglions are on either side of it; the stomach and lesser omentum are in front of it, and it is enveloped by the solar plexus of nerves, the branches of which accompany those of the artery.

The cœliac axis is about half an inch long, it bends a little downwards and to the left side, and divides into three large branches, which supply the stomach, spleen, and liver, also the duodenum, pancreas, and omentum; the branch which goes to the stomach is the smallest, that to the spleen is the largest, at least in the adult; in the infant the hepatic branch is the largest of the three. The cœliac axis before its division frequently sends small branches to the diaphragm, to the renal capsules, and to the surrounding cellular membrane; one of the proper phrenic arteries often arises from it. The cœliac axis presents great variety in length and size in different subjects, not unfre-

quently it divides into two branches only, in which case that which ought to be its third, will arise from the aorta, or from one of the renal arteries.

## I.

## ARTERIA GASTRICA VEL CORONARIA VENTRICULI,

Is the smallest of the three branches of the coeliac axis, it often arises from the aorta and sometimes from the splenic artery, it is distributed to the stomach.

The gastric artery runs upwards, forwards and towards the left side, enters the space between the laminae of the lesser omentum and the lesser curvature of the stomach, and having arrived near the cardiac orifice, it divides into two branches, a superior and an inferior: previous to its division it often gives off the left hepatic artery.

RAMUS SUPERIOR subdivides into several arteries, some of which ascend along the posterior surface of the oesophagus, and inosculate with the arteries which that tube receives from the thoracic aorta; others are distributed to the anterior and posterior walls of the stomach, ramify between its mucous and muscular coats and are directed principally towards the great or splenic end of this organ, where they anastomose with branches of the splenic artery.

RAMUS INFERIOR. This branch is the larger of the two branches into which the gastric artery divides; it appears the continuation of the original trunk; it bends downwards and to the right side, runs

between the laminæ of the lesser omentum towards the pylorus, where it anastomoses with the superior pyloric artery, a branch from the hepatic. The *Ramus inferior* in this course gives off several branches to the stomach and lesser omentum; the latter are small, the former are long and large; they are distributed to each surface of the stomach, and inosculate with the gastro-epiploic arteries which run along its great curvature. The gastric artery frequently sends a branch to the left lobe of the liver, in which case the trunk of this artery is as large as the hepatic artery.\*

## II.

### ARTERIA HEPATICA.

THIS large artery may be exposed by removing the anterior lamina of the lesser omentum, and drawing down the pyloric extremity of the stomach, together with the superior transverse portion of the duodenum, and by raising the liver towards the ribs.

From the celiac axis the hepatic artery takes a transverse course as far as the pylorus; it then inclines upwards, forwards, and towards the right side, and near the transverse fissure of the liver, terminates by dividing into the right and left hepatic arteries, which supply the two great lobes of this organ. The hepatic artery is surrounded by a plexus of nerves, and

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\* In the museum of the College of Surgeons, there is a preparation of a large aneurism of this artery close to the stomach.

is enclosed in the lesser omentum and capsule of Glisson, together with the vena porta and biliary ducts; the artery being placed to their left side or nearer the mesial line. Before the hepatic artery divides, it sends off two branches, viz., *arteria pylorica superior*, and *arteria gastro-duodenalis*; it also gives small branches to the pancreas and surrounding cellular membrane.

1. ARTERIA PYLORICA SUPERIOR. This branch arises from the hepatic artery, above and behind the pyloric extremity of the stomach towards which it runs; it gives small branches to it and to the pancreas, and then turns along the lesser curvature and meets the inferior branch of the *arteria coronaria ventriculi*.

2. ARTERIA GASTRO-DUODENALIS, arises close to the last described branch, sometimes before it; it accompanies the ductus choledochus between the superior portion of the duodenum and the pancreas, and soon divides into two branches, viz., *arteriæ pancreatica-duodenalis*, and *gastro-epiploica dextra*.

The gastro-duodenalis is a large but short artery; before it divides it gives off two or three small branches, *arteriæ pyloricæ inferiores*, to the inferior part of the pylorus and to the pancreas.

*Arteria pancreatica-duodenalis* is the smaller of the two branches, it is exposed by raising the ascending layer of the mesocolon from the pancreas, and separating the latter from the duodenum. This artery takes its course between these two organs and gives off branches from either side for their supply;



on the posterior surface of the pancreas one or two long branches may be seen accompanying the duct of this gland, and anastomosing with branches of the splenic artery. The pancreatica-duodenalis artery continues to run in the concavity of the duodenum as far as the root of the mesentery, and it there inosculates with the pancreatic branches of the superior mesenteric artery.

2. *Arteria gastro-epiploica dextra*. This branch runs downwards, forwards and to the left side, enters the space between the laminæ of the great or gastro-colic omentum, and the convex edge of the stomach. The right gastro-epiploic artery is of considerable size, in general it is larger than the short trunk of the gastro-duodenalis, from which it has arisen; it partly supplies the stomach and great omentum, to the latter it gives off several branches, which are remarkably long and tortuous, and which descend to the lowest part of this process; to the stomach also it gives numerous branches, and about the centre of its convex margin it meets the left gastro-epiploic artery, a branch from the splenic.

The gastric and epiploic arteries are situated in a similar manner between the laminæ of the great and little omenta, they are each surrounded by a quantity of loose cellular membrane; when the stomach is empty and contracted, they are about half an inch, and in some places fully an inch distant from that viscus, but in proportion as the latter becomes distended it passes between the folds of which the omenta are composed, and then these arteries which be-



fore were very tortuous become straight, and are brought close to the curvatures of the stomach, each lying in a triangular space the base of which is the stomach and the sides are the laminæ of the omenta. This observation applies to the other arteries which supply the membranous viscera in the abdomen.

The arteries of the stomach and intestines all ramify in a similar manner, between the muscular and mucous coats; if minutely injected, the mucous or villous surface will be found deeply tinged with the colour of the fluid, and will appear as if wholly composed of blood vessels; but the peritoneal or serous coat is not affected even by the most minute injections.

3. *Arteria hepatica sinistra*, opposite the superior angle of the duodenum, and about an inch from the transverse fissure of the liver, the hepatic artery divides into its right and left branches; the left is the smaller of the two, it passes towards the left extremity of the transverse fissure of the liver, in front of the vena porta, and entering the groove which contains the remains of the ductus venosus, it sinks into the substance of the left lobe of the liver, and soon subdivides into ramifications too numerous and too minute to be traced by the knife of the anatomist. The left hepatic artery sometimes arises from the *arteria coronaria ventriculi*, and sometimes from the trunk of the aorta.

4. *Arteria hepatica dextra* is larger than the last described artery; it passes between the vena porta and hepatic ducts, towards the right extremity of the transverse fissure, and before it enters the liver it sends

off a branch, *arteria cystica*, to the gall bladder ; this small artery accompanies the cystic duct to the neck of the gall bladder, where it divides into two branches, one of which ramifies very minutely between the coats of this viscus ; the other passes between the gall bladder and the liver, to both of which its branches are distributed.

The right hepatic artery then enters the liver at the right extremity of the transverse fissure, and spreads through its substance in the same manner as the left ; both these branches ramify through this organ from the centre towards the circumference, and are each accompanied by a branch of the vena porta and of the biliary duct ; branches of these three vessels are always found together in the substance of the liver, and are surrounded by that loose cellular tissue which enters it at the transverse fissure ; if a section of the liver be made perpendicularly, that is, from its thick towards its thin edge, the branches of these three vessels will be divided at right angles, and their open mouths may be seen on the cut surfaces, and the vessels themselves will be found retracted into the loose cellular tissue that surrounds them.

The right and left hepatic arteries, before they enter the substance of the liver, send off several small branches, which ramify on its surface ; these are not in general filled by a common injection, but if a fine fluid be successfully injected, the whole surface of the liver may be observed to be minutely vascular ; the vessels are arranged in a radiated manner, particularly on its convex surface. In a minutely injected sub-

ject also we may observe several anastomoses between the hepatic and other arteries; branches from the phrenic arteries descend from the diaphragm on the liver; branches also from the intercostal and lumbar arteries pass from the abdominal parietes to this organ, and inosculate with the superficial branches of the hepatic arteries. I have frequently too seen branches extending along the suspensory ligament of the liver to the umbilicus, thus connecting the hepatic arteries to the internal mammary and epigastric. These superficial branches of the hepatic artery are well delineated by Ruysch.—*Opera Ruyschii*, epis. v.

## ARTERIA SPLENICA.

THE origin of this artery may be seen by separating the cellular membrane and nerves which surround it behind the lesser arch of the stomach, and its termination may be exposed by carefully dissecting between the great end of the stomach and the spleen. A better view of the splenic artery may be obtained by raising the stomach and great omentum towards the thorax, then dissecting the ascending layer of the mesocolon from the pancreas, and drawing down the upper edge of this gland, the whole course of the artery may be seen. The splenic artery may be still more satisfactorily seen by turning down the stomach, having first tied the cardiac orifice and divided the œsophagus.

The splenic artery in general appears larger than the hepatic, it is very tortuous, when injected it ap-

pears remarkably so ; its course does not exceed five or six inches in length, although if detached from the subject and extended, it will often exceed twelve inches. The accompanying vein is not so tortuous. It is accompanied by several filaments from the solar plexus of nerves, these run in a straighter manner along the vessel, and thus serve to connect the coils of the latter to one another. I have observed that the coats of this artery are remarkably thin both in its trunk and branches, and in injecting subjects I have found it to burst in old persons more frequently than any other artery in the body.

The course of this artery is first backwards and to the left side, then forwards and downwards ; it runs along the superior and posterior margin of the pancreas, accompanied by the splenic vein, which lies inferior to it ; the splenic artery passes over the crus of the diaphragm, the semilunar ganglion and the renal capsule of the left side ; in this course it gives off several branches—1st, *pancreaticæ parvæ* ; 2nd, *pancreatica magna* ;—3rd, *vasa brevia* ;—4th, *arteriæ splenicæ* ; and 5th, *arteria gastro-epiploica sinistra*.

1. *ARTERIÆ PANCREATICÆ PARVÆ*. As the splenic artery runs in the groove in the pancreas, it sends off these branches to supply this gland ; they are very numerous, but observe no particular arrangement ; they inosculate with the right pancreatic arteries from the *pancreatico-duodenalis*.

2. *ARTERIA PANCREATICA MAGNA* arises from the splenic artery near the left extremity of the pancreas, it sinks into the substance of this gland, and

runs from left to right, giving off several small branches to the grains or particles of which this conglomerate gland is composed. This artery is near the posterior surface of the pancreas, and accompanies the duct of this gland towards the duodenum, where it anastomoses with branches of the pancreatico-duodenalis. In many cases I have not been able to see this branch; it is I believe often wanting, its place being supplied by the pancreaticæ parvæ, and by branches from the pancreatico-duodenalis.

3. VASA BREVIA. These vessels, five or six in number, arise from different sources; some arise from the trunk of the splenic artery before it arrives at the spleen; others proceed from the splenic branches, as they are entering the spleen; and in some cases one or two come from the substance of the spleen:—all these arteries pass between the laminæ of the gastro-splenic omentum to the great end of the stomach. Each of the vasa brevia is from two to three inches in length; in this course, they frequently communicate with one another, and having arrived near the stomach, they all divide into several branches, which ramify on the anterior and posterior surfaces of this organ, and anastomose with the gastric artery above, and with the epiploic arteries below, thus completing on the left side the vascular circle which surrounds the stomach.

4. ARTERIÆ SPLENICÆ. As the trunk of the splenic artery approaches the spleen, it sends off five or six branches, some of which are of considerable

size; these vessels enter the spleen along its concave side, some at its fissure, others by the foramina which are placed above and below this fissure: these branches divide in the substance of the spleen in a manner similar to arteries in other glands; it is difficult, however, to trace them for any distance into this organ, their coats become very thin, and the tissue of the spleen is so soft, that it is almost impossible to affirm in what manner they terminate.

5. *ARTERIA GASTRO-EPIPLOICA SINISTRA* is the last branch of the splenic artery, and appears its continued trunk; it turns forwards, downwards and to the right side, is received between the laminæ of the great omentum and the convex edge of the stomach, and meets the *gastro-epiploica dextra*, a branch of the hepatic artery.

The left *gastro-epiploic* artery in this course sends off branches superiorly to the stomach, inferiorly to the great omentum; the former are distributed to the anterior and posterior surfaces of the stomach, and divide into several branches, which unite with those on either side, and form a complete net-work of vessels between the mucous and muscular coats; these branches inosculate with the splenic and gastric arteries. When the stomach is empty and contracted, the left *gastro-epiploic* artery is near an inch distant from the convex border of its left extremity, but when distended, the vessel is brought into close contact with it. The branches which the *epiploic* artery gives off inferiorly supply the great omentum; they are very long



and seldom give off any branches of magnitude to either side, but descend undivided vessels even to the lowest part of the omentum ; some of the largest then ascend on the posterior surface of this process, and arriving at the arch of the colon anastomose with the colic arteries. These long omental branches are generally surrounded by a line of adeps and are each accompanied by one or two veins ; they have very few anastomoses with their corresponding arteries on either side. In cases of old irreducible and strangulated omental hernia, in which the surgeon determines on excising the protruded portion, which is often much altered and diseased, these arteries may each require a fine ligature. As the left gastro-epiploic artery proceeds along the convex border of the stomach giving off the branches that have been just described, it meets the gastro-epiploica dextra ; these arteries anastomose not by small branches but the trunks unite, so as to appear like one continued vessel, forming an arch along the convex border of the stomach ; this arch of arteries is turned forwards when the stomach is distended, and in thin persons, it is said, can be felt pulsating through the abdominal parietes.—*See Academie des Sciences, 1715.*

Having now traced the three divisions of the cœliac axis to their termination, the student cannot fail to remark the numerous inosculations that exist between the branches of each ; the stomach appears the centre of these communications, on it we find several free anastomoses. Around its cardiac orifice, and on its splenic extremity, the arteria coronaria ventriculi and the

vasa brevia unite; along its lesser curvature an arterial arch extends, formed by the inferior branch of the coronary artery, and the pyloric branch of the hepatic; around the pylorus several small arteries anastomose; and the inosculation between the right and left epiploic vessels bounds its convex border.

Of all the membranous viscera in the abdomen, the stomach receives the largest supply of blood; it is completely encircled by arteries from which innumerable branches pass in every direction, communicate with each other, and ramify through all parts of its tissue. When the arteries of the stomach are minutely injected, the mucous or villous coat becomes so deeply tinged with the colour of the fluid, as to appear composed entirely of vessels; the left or splenic extremity appears more vascular than the right. When a portion of a minutely injected stomach is dried the vessels are found arranged in a reticular order, not unlike the manner in which they are distributed in the cutis.

When we contemplate the number and magnitude of the arteries which supply the stomach, and reflect on the functions which this organ performs, we may conclude that the powers of the circulation are exerted in it with considerable energy; how far the circulation is affected by the anastomoses we have just mentioned, presents to the physiologist an interesting subject for inquiry. The arteries of the stomach and intestines are remarkable for their freedom and form of inosculation; in all other situations except at the base of the brain, arteries communicate by small branches

but along the whole course of the membranous viscera of the abdomen, we perceive vessels of considerable size joining each other and forming arches, the convexities of which are directed towards the viscera to which they send numerous branches. It is probable these free inosculations may, to a certain degree, exempt these vessels from the influence of the laws of the general circulation, and so tend to establish a peculiar circulation, not merely for the nutrition of these organs, but also for the performance of their different functions. We know that the circulation is carried on with different degrees of energy in different parts and at different times, but how this is regulated or effected remains in obscurity ; we know also that the small arteries are possessed of great irritability and probably these anastomoses, almost peculiar to the arteries of the abdominal viscera, lessen or intercept in some way the force of the general circulation, and so favour the organic power of the small vessels exerting itself over their contents. These free anastomoses of the arteries may also admit of the more ready flow or diversion of the fluid they contain from one viscus to another, according as the very elaborate process of digestion may require an increased action in one part, and admit of a state of quiescence in another.

When we consider the magnitude and number of the arteries which supply the abdominal viscera, the manner in which they are spread out and anastomose with each other, and that the arteries are always full of blood, we must conclude that a considerable quan-

tity of this fluid is circulated among the organs in this cavity ; we may also infer that the course of the blood through the large arteries must be retarded by these peculiar inosculations, and therefore more powerfully directed to those viscera it is destined to supply.

## II.

## ARTERIA MESENTERICA SUPERIOR.

THE superior mesenteric artery is one of the largest branches which the abdominal aorta furnishes to the chylipoietic viscera; it supplies the intestinum jejunum and ilium, the cæcum, and all the colon, except its left descending portion.

The superior mesenteric artery and its numerous branches may be exposed without much dissection; raise the transverse colon and mesocolon towards the chest, and secure them in that position, let the mesentery and small intestines fall to the lower part of the abdomen, then dissect off the superior layer of the mesentery from the several glands and vessels which lie between the laminæ of this process; thus the whole course of the mesenteric artery will be seen except its origin, which may be afterwards exposed by dividing a small portion of the root of the mesocolon, and raising the inferior edge of the pancreas.

The superior mesenteric artery arises from the forepart of the aorta about a quarter of an inch below the celiac axis; as it descends it inclines at first a little towards the left side, lies close to the aorta and is covered by the vena porta and the pancreas; at the inferior edge of this gland it is separated from the aorta by the duodenum and by the left emulgent vein; at the lower edge of the duodenum it is received between the laminæ of the mesentery and then runs in

an oblique direction forwards, downwards and towards the right iliac region, where it terminates by supplying the ilium, cæcum and colon intestines. The superior mesenteric artery is accompanied by two veins and is enveloped in a plexus of nerves derived from the semilunar ganglions and the sympathetic.

The course of the superior mesenteric artery represents an arch whose convexity is directed forwards, downwards and to the left side, from which arise several (fifteen or twenty) arteries to supply the small intestines; the concavity looks upwards, backwards and to the right side; from it three large branches in general proceed.

The superior mesenteric artery in the first part of its course, that is, before it enters the mesentery, gives off three or four branches, which are distributed to the right extremity of the pancreas and to the inferior portion of the duodenum; these branches anastomose with the pancreatico-duodenalis, one of the divisions of the gastro-duodenalis artery which is derived from the trunk of the hepatic.

The three arteries which arise from the concavity of the arch which the mesenteric artery forms, are,—1st, *arteria colica media*;—2nd, *arteria colica dextra*;—and 3rd, *arteria ileo-colica*.

1. *ARTERIA COLICA MEDIA* arises from the superior part of the mesenteric artery, while this vessel is covered by the transverse mesocolon, between the laminæ of which process it runs upwards and forwards towards the umbilicus, and about the centre of the mesocolon it divides into two branches, a right and



left; these diverge and each sends off small branches to the colon and anastomoses with corresponding arteries on either side. The left branch inosculates with the *arteria colica sinistra* which is derived from the inferior mesenteric; this inosculation forms an arch which is convex towards the colon, and from which several branches proceed to supply that intestine. The right branch inosculates in a similar manner with the ascending branch of the *colica dextra*.

2. *ARTERIA COLICA DEXTRA* arises from the mesenteric artery, about two inches beyond the last described branch; it also runs between the laminæ of the mesocolon, towards the right ascending colon, and divides into two branches, a superior and inferior; the former inosculates with the right branch of the *arteria colica media*, the latter with the ascending branch of the *ileo-colica*; these inosculations also form arches, from the convexity of which proceed many small branches to supply the colon. The *arteria colica media* and *dextra* often arise by a common trunk.

3. *ARTERIA ILEO-COLICA*, is the terminating branch of the superior mesenteric artery, it runs between the laminæ of the mesentery to the right iliac region and divides into three sets of branches, a superior, middle, and inferior. The superior ascends to meet the descending branch of the *colica dextra*; the inferior descends to meet branches from the mesentery, or from the convex side of the mesenteric artery; and the middle runs to the right iliac region, and near the junction of the ilium and cæcum divides into several branches which communicate with the arte-

ries above and below, forming arches with them, from the convexity of which several large branches arise to supply these two intestines, also the vermiform appendix and the ileo-cæcal and colic valves.

The branches of the ileo-colic artery which supply the cæcum and vermiform process subdivide and often anastomose twice or thrice before they arrive at the intestine.

From the convex side of the mesenteric artery arise fifteen or twenty branches, which supply the jejunum and ilium intestines; they are seen by simply unfolding the different plaits of the mesentery; all these arteries have nearly a similar course and termination; they run nearly parallel between the laminæ of the mesentery, the middle branches are the longest. Soon after their origin they divide into two branches, each of which unites with a similar branch on either side; an arch is thus formed, which is convex towards the intestine; from its convexity arise several branches, which soon divide and communicate with those on either side and thus again form arches similar to the first but smaller; from these arches branches again arise and in some cases communicate a third or even a fourth time. From the last arches arteries run in a straight direction to encircle the intestine, on which they subdivide minutely and form numerous inosculation on their mucous coat, so that when successfully injected this membrane seems wholly composed of vessels.

The branches of the mesenteric artery are equally remarkable with those of the cœliac axis for their free

and numerous inosculations; all the branches which arise from its convex side communicate with each other, and at the cæcum in the right iliac region they unite with the ileo-colic artery, from whence to the left iliac region an anastomosis exists in the mesocolon between the three branches of the superior and the ascending branch of the inferior mesenteric arteries; this latter artery the student should next examine.

## III.

## ARTERIA MESENTERICA INFERIOR.

THE inferior mesenteric artery is the next branch which the abdominal aorta sends to the chylopoietic viscera; it is an artery of considerable magnitude but smaller than the superior mesenteric: to expose it the student should raise the mesentery and small intestines together with the transverse colon towards the thorax, and divide the peritoneum covering the aorta, the spine and the left kidney.

The inferior mesenteric artery arises from the left side of the aorta, about an inch or less above its division into the common iliacs and an inch and a half or two inches below the origin of the renal arteries. The inferior mesenteric artery runs obliquely downwards and to the left side its course being somewhat curved, the convexity towards the left iliac region; it soon divides into three branches, viz.—1st, the *arteria colica sinistra*;—2nd, the *arteria sigmoidea*;—and 3rd, the *arteria hæmorrhoidalis superior vel interna*.

1. *ARTERIA COLICA SINISTRA* ascends in front of the left kidney, and divides into an ascending and descending branch; the former inosculates, and forms an arch with the *colica media*, a branch of the superior mesenteric artery; it also gives several branches to the left lumbar colon. The descending branch unites in a similar manner with the sigmoid artery.

2. *ARTERIA SIGMOIDEA* runs transversely, it

crosses the psoas muscle to the sigmoid flexure of the colon, and divides into several large branches, which supply this portion of the intestine, and anastomose with the last described artery; this artery also sends some small branches to the ureter, and to the psoas and iliacus internus muscles. The inferior mesenteric artery often gives off two or three distinct branches to this part of the intestine.

3. *ARTERIA HÆMORRHOIDALIS SUPERIOR*, is the largest branch of the inferior mesenteric artery; it runs towards the left ilio-sacral articulation, crosses the ureter and the left iliac artery and vein, is received between the laminæ of the mesorectum, and descends into the pelvis, along the posterior part of the rectum, which intestine it supplies with numerous branches. Opposite the middle of the sacrum, the hæmorrhoidal artery divides into two large branches, which descend along the sides of the rectum; these subdivide into several small branches, which anastomose with each other and with the middle hæmorrhoidal arteries on each side, which are branches from the internal iliac. Some long branches of the superior hæmorrhoidal artery descend as low as the anus, and there anastomose with the external hæmorrhoidal, which are branches from the internal pudic.

The superior hæmorrhoidal artery is accompanied by some nerves, and by several large tortuous veins. The hæmorrhoidal artery and its branches deserve the attention of the surgical anatomist, as they are concerned in the operation for fistula in ano; the student may observe that this vessel descends on the back

part of the rectum, to within one finger's length, or about four inches of the anus, before it divides; this will apprise him of the danger of dividing the rectum to that height, in case the disease extends in that direction.

The lower part of the rectum is extremely vascular, the surrounding cellular membrane containing numerous veins and arteries; in cases of long continued disease these vessels become much enlarged, and when divided in operations for the cure of hæmorrhoids or of fistula, or for the removal of excrescences of the mucous membrane, which sometimes protrude at the anus, they bleed so profusely as frequently to endanger the life of the patient; the hæmorrhage is not in general alarming at the time of the operation, but in some hours after we may find the patient reduced to a state of great weakness, although little or no blood is seen; however, it flows freely into the intestine, and the contraction of the sphincter or the compresses at the wound prevent its escape externally; the rectum becomes distended, and the patient cold and weak, he feels great irritation about the neck of the bladder, and tenesmus, and on going to stool he discharges a quantity of blood, partly fluid, partly coagulated; this in some cases is followed by syncope, which may assist in putting a stop to further hæmorrhage. Should, however, the bleeding recur, the surgeon must open the wound, and having introduced a large piece of sponge, with a ligature attached to it, into the rectum, higher than the divided vessel, so as to prevent the blood from ascending into the intestine,



he should then apply dossils of lint to the bottom of the wound, and retain these by a well regulated graduated compression, or by the hand of a careful assistant.

The student can again examine the superior hæmorrhoidal artery when dissecting the vessels in the pelvis.

The superior and inferior mesenteric arteries communicate so freely along the left descending colon, that if the abdominal aorta be tied between the origin of these two arteries, and the subject injected from the heart, the fluid will pass through this mesenteric inosculature to the lower part of the aorta, and so to the inferior extremities.

The branches of the mesenteric arteries are remarkable not only for the freedom, but also for the form of their inosculations. The branches of the superior mesenteric artery which supply the small intestines, communicate with each other more frequently than those which go to the colon, or than those of the inferior mesenteric; the anastomoses of the former present a reticulated appearance in the mesentery, the branches enclosing spaces of different area and figure; the branches which supply the large intestine seldom anastomose with each other more than once or twice between their origin and termination. From these anastomoses, both of the superior and inferior mesenteric arteries, branches proceed in a straight direction to the concavity of the intestine, and pass some on its anterior, others on its posterior surface; according as the intestine is empty or distended, it appears at a

greater or less distance from the origin of these arteries. When these straight branches have arrived at the intestine they divide very minutely, and form a complete network of vessels between the mucous and muscular coats; this network is well seen in a minutely injected intestine which has been dried, and then suspended in oil of turpentine.

The small intestines receive their supply of blood from their concave side only, whereas the stomach receives its arteries both from its concave and convex borders, but particularly from the latter; the arteries which supply this organ have but one inosculation with each other before their branches become reticulated in its coats, but the arteries of the small intestines form a remarkable network in the mesentery, which is connected by straight branches to that which is in their parietes.

The vessels which are distributed to the colon, are not so numerous as those of the stomach and small intestines, and when all the arteries of the alimentary canal have been minutely injected, a striking difference appears in the degree of vascularity in the mucous membrane of the large and small intestines: the large intestines are also supplied principally from their concave edge; a few arteries, however, from the omentum and abdominal parietes occasionally pass to the convex border of the colon and cæcum; the arteries which supply the large intestine are not so reticulated either before they arrive at the intestine, or even at their termination on its parietes.

If we encourage the idea of the functions of ves-

sels being at all depending on or affected by their previous anastomoses, we may form some conjecture as to the cause of those differences which exist in the anastomoses of the arteries which supply the stomach, the small and the large intestines.

The student may now proceed to examine the other branches which the abdominal aorta sends off; namely, the phrenic, capsular, renal, spermatic, lumbar, and middle sacral arteries: to expose these, he should remove the stomach and intestines, having first tied the œsophagus and rectum, and having divided the gastric, splenic, and mesenteric arteries, also the biliary ducts, leaving the liver, kidneys, and vena cava, in their situation; a better view of the aorta will be now obtained, and of the manner in which it is pushed forwards by the convexity of the lumbar vertebræ, also of the opening between the crura of the diaphragm, through which this artery enters the abdomen.

## ARTERIÆ PHRENICÆ.

THE phrenic arteries are two in number, they are the first branches of the abdominal aorta, and arise from its anterior part immediately above the cœliac axis; each artery passes upwards, outwards, and forwards to the diaphragm, to which it is distributed. The phrenic artery of the left side passes behind the œsophagus, that of the right side behind the liver and vena cava. At the posterior edge of the cordiform tendon each artery divides into two branches, an external and internal; the former supplies the fleshy fibres of the diaphragm on each side, and divides into numerous branches, which run towards the ribs, and inosculate with the intercostal arteries. The internal branch of each phrenic artery is directed forwards round the cordiform tendon, distributes its branches in every direction; behind the xyphoid cartilage it anastomoses with its fellow, and with the internal mammary arteries. The internal branch of the phrenic artery of the right side sends some small branches to the vena cava, which anastomose with the superior phrenic artery, a branch of the internal mammary; on the left side this branch sends small arteries to the œsophagus, which in like manner communicate with the superior phrenic, and with the œsophageal branches of the thoracic aorta. The phrenic arteries in the first part of their course give off several small branches to the crura of the diaphragm, to the pancreas, to the semilunar ganglions, and to the cellular membrane which

surrounds them, also to the renal capsules, along the superior edge of which each artery runs; the spleen also on the left side, and the liver on the right, sometimes receive small branches from these vessels.

The phrenic arteries are of uncertain origin, they often arise by a common trunk; sometimes one or both arise from the cœliac axis, or from one of its branches, and not unfrequently the right phrenic artery is found to arise from the renal.

On the diaphragm we find several inosculations between the arteries of the neck, thorax, and abdomen. A muscle of such importance in the animal economy as the diaphragm must receive a great quantity of blood; the phrenic arteries are not the only source from which it is supplied, the phrenic nerve of each side has its accompanying artery, which is derived from the internal mammary, these branches are distributed to the centre of this muscle; the six inferior intercostal arteries, and the internal mammary, send branches to its fleshy circumference, and the two or three superior lumbar arteries in like manner supply its crura and the posterior part of each ala.

## ARTERIÆ CAPSULARES VEL ATRABILIARIÆ.

THE arteries which supply the renal capsules are very small in the adult, but in the fœtus they are as large as the renal arteries; they are very irregular in their origin. These bodies in general receive their blood from three sources, namely, from the phrenic above, from the aorta in the centre, and from the renal below.

The proper capsular arteries arise on each side of the aorta, opposite the mesenteric artery; they pass obliquely upwards and outwards, and are distributed to the renal capsules and to the surrounding cellular membrane; they also send branches to the psoas muscle and to the different viscera in their vicinity.

## ARTERIÆ RENALES VEL EMULGENTES.

THE renal or emulgent arteries arise between the two mesenteric arteries, they are the largest branches of the abdominal aorta, with which they form an angle a little less than a right one. The two renal arteries are nearly of the same size, the left is shorter than the right, and covers its accompanying vein; the right renal artery in general arises lower down than the left, it passes behind the vena cava, and is covered by its corresponding vein; the relation which these arteries and veins bear to each other is very irregular. Each renal artery passes obliquely downwards, backwards, and outwards, towards the kidney, and in this course



gives off small branches to the renal capsule, to the ureter, and to the surrounding cellular membrane and muscles. At the pelvis of the kidney each artery generally, but not constantly, lies between the vein and ureter, the former in front of, the latter behind the artery. The renal arteries then divide into four or five branches, which pass into the substance of the kidney as far as the papillæ; around these each artery divides into several minute branches, which pass between the tubuli uriniferi, as far as the inner edge of the cortical substance, where they unite with one another, forming arches, the concavity of which is directed towards the tubuli, which are thus separated from the cortex; from the convexity of these arches proceed numerous branches, which ramify through the cortical substance, some extend even to the capsule of the kidney, and ramify upon it.

If the kidney be minutely injected and corroded, the cortex is found to consist almost wholly of arteries and veins; these vessels communicate very freely with each other, and with the branches of the ureter, as is proved by injection. When the branches of the renal arteries have penetrated the kidney, they twine around the veins and the branches of the ureter. We frequently find two or three, or even more, renal arteries on one or both sides, sometimes one of these will pierce each extremity of the kidney, and the others will enter at its pelvis. When the renal arteries thus arise in separate branches, the superior is often derived from the mesenteric, and the inferior from the

common iliac artery; the renal veins are more regular in their number than the arteries.

The chief glandular viscera of the abdomen, as the liver, spleen, and kidneys, are each supplied in somewhat a similar way; a large artery sinks into their substance, and divides into numerous branches, which ramify through all parts of their structure; the kidneys, in particular, are remarkable for the size of the arteries which supply them; these vessels too are very short, so that the circulation in these glands may, as Bichat observes, receive a more lively impression or impulse from the general system, which may in some degree account for the rapidity of the urinary secretion.

#### ARTERIÆ SPERMATICÆ.

THESE two arteries arise immediately below the renal from the fore part of the aorta, at a very acute angle; they pursue a very tortuous course downwards and outwards, accompanied by one or two veins, and by several small nerves, which descend from the renal plexus and from the sympathetic nerve. Each spermatic artery passes obliquely across the psoas muscle and the ureter, and descends on the external side of this vessel; the right spermatic artery crosses the vena cava also. The spermatic arteries in the male subject incline more outwardly in their descent than in the female, and arriving at the internal abdominal ring, each joins the vas deferens, and descends, forming a part of the spermatic cord, to the testicle.

The right spermatic artery often arises from the

right renal; sometimes there are two spermatic arteries on one side, and but one on the opposite.

While the spermatic artery lies in the abdomen, it gives off several small branches to the psoas muscle, to the ureter, and surrounding cellular membrane; in the inguinal canal it gives off small branches to supply the muscles, which anastomose with the epigastric and with the superficial branches of the femoral. The spermatic artery in some subjects is found larger at its lower than at its upper extremity. As the artery approaches the testicle, it divides into six or seven branches, two or three of these accompany the vas deferens and are distributed to the epididymis; the other branches pass forwards, pierce the tunica albuginea at its posterior part, and enter the substance of the testicle; here they again subdivide into numerous branches, which inosculate with each other and form beautiful arches, many of which can be discerned through the tunica albuginea as they run between it and the tubuli testis; others pass along the septa of this gland, and communicate with the tubuli seminiferi. Beneath the tunica albuginea or the fibrous coat of the testicle, the blood vessels are arranged in considerable number, so as form a soft, vascular surface or membrane analogous to the pia mater, from which several straight vessels extend along the septum of the testicle.

In the female the spermatic arteries arise in the same situation as in the male, and pursue nearly a similar, but in general a more tortuous course, as far as the pelvis, but then each artery bends inwards, and

is received between the laminæ of the broad ligament of the uterus, which conducts it to the ovarium. The spermatic artery then divides into several branches, some ramify on the posterior surface of the ovary, and in very minute injections will be found to enter its substance, other branches descend along the Fallopian tubes to the uterus, in the structure of which they anastomose with the proper uterine arteries from the internal iliac. One or two small branches of each spermatic artery are reflected outwards along the round ligament of the uterus, and passing through the inguinal canal, are distributed to the muscles and integuments in the groin, where they anastomose with the superficial branches of the femoral.

During the first six months of foetal life, the spermatic arteries are short, as the testes then lie by the side of the spine, below the kidneys. The spermatic arteries in the first part of their course are straight, but as they approach the testes or ovaria, they become extremely tortuous; it has been rightly observed by Mr. C. Bell, that those organs of the human body, which have an occasional remission of their activity, or which have an occasional call for an increase of their functions, are remarkable for the tortuous form of their arteries; the vessels of the uterus, testicle and spleen, are good examples of this fact.\*

In the operation of castration, the contraction of the cremaster muscle and the retraction of the spermatic artery within the cellular membrane of the

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\* See Essay on the Circulation of the Blood.

cord, have been found to produce some difficulty in the application of the ligature to the divided artery; to obviate this, it has been proposed to include in a ligature the entire cord before dividing it, and the cord being cut across, to tie the spermatic artery separately before the general ligature is removed. This proceeding, however, adds considerably to the pain of the operation, which may be avoided and the object effected by the operator taking hold of the cord with his left hand, and having divided it, by drawing out the artery with the tenaculum or forceps so that an assistant may secure it in a ligature. While the surgeon still holds the cord, he should examine if it be necessary to tie more than one artery, as in cases of long continued disease the branches of the spermatic and epigastric often become enlarged.

Between the origin of the spermatic arteries and of the inferior mesenteric, the aorta generally gives off some small branches to the ureter, to the fat which surrounds the kidney, and to the cellular membrane, and lymphatic glands which lie along the lumbar vertebræ; these branches are described by some writers under the name of the *adipose* and *ureteric arteries*; they, however, are in general so irregular and uncertain, that I have not considered it necessary to direct the attention of the student particularly to them.

Although the coats of the ureter do not appear very vascular, yet they receive arteries from several sources, namely, from the aorta, the renal, spermatic, lumbar, iliac, and hypogastric arteries. These different branches also supply the surrounding cellular membrane and muscles.

The adeps around the kidney also receives arteries from different sources, from the phrenic, capsular, renal, and spermatic, and occasionally from the aorta; these branches anastomose on the kidney with the arteries of that gland, and on the surrounding muscles with the lumbar arteries.

Numerous small arteries may be seen ramifying on the aorta itself; some of these arise from the different arteries in the vicinity; others arise from the parent trunk, twine around it in a serpentine course, distributing their branches to its coats, and anastomosing with each other. In no part of the arterial system are these small vessels (which are commonly called the *vasa vasorum*) more distinct and numerous than around the abdominal aorta; in a young subject, minutely injected, they render the external coat of this vessel and the surrounding cellular membrane so vascular, as to give to its sheath the appearance of an highly organized membrane, in which also may be traced innumerable filaments of nerves derived from the sympathetic, and its different ganglia; this tissue, so abundantly supplied with nerves and vessels, is not confined to the aorta, but may be seen on its different branches, and particularly on those which supply the chylopoietic viscera.



## ARTERIÆ LUMBALES.

THE lumbar arteries arise from the posterior part of the aorta, nearly at right angles, opposite the intervertebral ligaments; they are generally five in number on each side; the fifth or last sometimes arises from the common iliac arteries; the lumbar arteries of opposite sides occasionally arise in common and sometimes two or even three of the same side arise together. The lumbar arteries are all nearly alike in their course and termination, and resemble very much the intercostal arteries; the superior pass transversely, the inferior descend a little; they run from their origin outwards and backwards along the sides of the vertebræ, behind the sympathetic nerve the crus of the diaphragm and the psoas muscle both which muscles they supply.

When each lumbar artery has arrived opposite the space between the transverse processes of the vertebræ, it gives off three sets of branches; the first are the spinal, which are two in number, and of considerable size; these branches are conducted along the lumbar nerves through the intervertebral foramina into the spinal canal, one branch is then distributed to the spinal marrow and its membranes: the other runs on the posterior part of the body of the vertebra, meets the corresponding artery from the opposite side, and both send several branches into the substance of the bone and into the intervertebral ligaments; the princi-

pal branches enter the bone through a large hole that may be seen on the back of the body of each lumbar vertebra.

The second set of branches of the lumbar artery are the posterior muscular branches ; these pass backwards between the transverse processes of the lumbar vertebræ to supply the lumbar mass of muscles, some are very long and large, and anastomose with each other and with the posterior branches of the intercostal arteries.

The third set are the external ; this, which is generally single, is the largest, and appears to be the continuation of the original trunk ; it is by no means, however, so large as the corresponding branch of each intercostal artery. The external or abdominal branch of each lumbar artery passes outwards between the psoas and quadratus lumborum muscles, giving small branches to each, also to the diaphragm, kidney, renal capsule and the surrounding cellular membrane, and then divides into several long branches which run between the laminæ of the abdominal muscles, accompanied by branches of the lumbar nerves ; these arteries anastomose with the intercostals above, with the ilio-lumbar and circumflex ilii below, and with the epigastric and internal mammary in front.

## ARTERIA SACRA MEDIA.

THIS is the last branch of the abdominal aorta ; it arises from its posterior part a little above its division ; it sometimes comes from one of the iliacs (the right) or from the last lumbar artery.

The middle sacral artery is almost as large as one of the lumbar arteries, it descends nearly in the direction of the middle line of the sacrum, and close to this bone as far as the coccyx, where it divides into branches which bend to either side and form an arch with the lateral sacral arteries. The middle sacral artery gives off branches to the rectum, to the sacrum, and to the muscles which are attached to it, it also sends off transverse branches at each division of the sacrum, which supply this bone, and anastomose with the lateral sacral and hæmorrhoidal arteries.

I think I have observed this artery to be larger in the fœtus in proportion, than in the adult. In animals it may be named the “caudal artery,” and is always of a proportionate magnitude to that of the tail ; where this appendix is large, as the prehensile tail of some monkeys, or as in the kangaroo, this artery will be found of considerable size. In fish this artery appears as the termination of the aorta. In tailless animals it will be absent.

## ARTERIÆ ILIACÆ COMMUNES.

ON the body of the fourth lumbar vertebra, or on the ligament between that and the fifth, the abdominal aorta usually divides into the two iliac arteries; the point of its division is nearly opposite the left margin of the umbilicus; great variety, however, is observed in this respect, it sometimes divides so high as the third and sometimes so low as the fifth lumbar vertebra.

The right and left common iliac arteries are of equal size; they diverge, each inclining downwards and outwards, and opposite the ilio-sacral symphysis they divide into two large branches, named the external and internal iliac arteries; the former supplies the lower extremity with blood; the latter supplies the viscera and the parietes of the pelvis.

The common iliac arteries form an acute angle with each other, this angle is observed to be more open in the female than in the male: these large arteries are covered by the peritoneum: the division of each is crossed anteriorly by the ureter; the *psoæ* muscles are situated on the external side of them; the commencement of the rectum is anterior to the artery of the left side, and the termination of the ilium, the left side of the cæcum, and the vermiform appendix are connected to that of the right. The common iliac artery of the right side is somewhat longer than that of the left, and takes a more oblique course across the last lumbar

vertebra, it also passes over the left common iliac vein and the commencement of the vena cava; the common iliac artery of the left side descends more in the direction of the aorta, and lies external and anterior to its accompanying vein. These arteries seldom give off any branch of magnitude; they both give small branches to the peritoneum, to the *psoæ* muscles, to the ureters, and to the surrounding cellular membrane: occasionally the right one gives off the middle sacral, and the left the last of the lumbar arteries. In young subjects these arteries are generally very straight, but in old subjects I have frequently found them extremely tortuous, particularly that on the right side.

The student may now proceed with the dissection of the internal and external iliac arteries. It is a matter of no importance to which the student shall first direct his attention. We shall first describe the internal iliac artery.

ARTERIA ILIACA INTERNA VEL HYPOGASTRICA,  
VEL UMBILICALIS.

THE student should examine this artery in the foetus, as well as in the subject of maturer age. The internal iliac artery presents a striking difference in its magnitude, course, and termination, in the child before or at birth, and at some time subsequent to that period. This artery in the foetus usually receives the name of umbilical or hypogastric; in after life it is commonly called internal iliac: if examined in the foetus it will be found twice as large as the external iliac, and will appear as the continuation of the common iliac artery; whereas, in the adult, the external iliac exceeds the internal nearly in the same proportion, and appears not only in size but also in direction, as the continued trunk of the primitive iliac.

We may first briefly consider the course and termination of the umbilical or hypogastric arteries in the foetus; at this age these arteries proceed from the division of each common iliac artery, or from the iliosacral symphysis, downwards and forwards to the bladder, forming in this part of their course an arch, the convexity of which is directed downwards, and from which arise several small branches. Each hypogastric artery then ascends along the side of the bladder to its superior fundus, and thence runs on either side of the urachus, between the peritoneum and recti muscles, to the umbilicus. Having passed through



this opening, these arteries become a part of the umbilical cord, and twine around the umbilical vein; in this part of their course they appear smaller than while they were in the abdomen; when they have arrived near the placenta they sometimes inosculate with each other, and then branch out into numerous ramifications through all parts of this spongy vascular substance. In utero these arteries serve the offices of veins, and are the only media by which the blood can be returned from the foetal to the maternal circulation. After birth when the umbilical vessels are tied a coagulum of blood fills each of these arteries, and extends from the umbilicus to the side of the bladder; these vessels then gradually contract, the coagulum becomes absorbed and in a very few years after birth, nothing but a ligamentous substance marks the former course and situation of these arteries between the bladder and the umbilicus. While this change is being effected, not only is the external iliac artery increasing in size, but also those branches which arise from the back part of the internal iliac. If examined at a still more advanced period of life, this obliteration of the artery is found to have extended still farther back, so that from the sciatic notch to the bladder a very small branch, or sometimes only a ligamentous substance exists.

The student may now proceed to examine the internal iliac artery in the adult subject. The trunk of this artery may be exposed without much dissection; raise the fold of the peritoneum which extends from the rectum to the bladder, by detaching it from the

iliac fossa towards the pelvis, and avoid injuring the ureter, vas deferens or internal iliac vein. The internal iliac artery separates from the primitive iliac opposite the ilio-sacral symphysis, and is generally higher on the right side than on the left, it is a large but short trunk, seldom more than an inch and a half or two inches long before it gives off its branches: from its origin it runs tortuously downwards and backwards, converging a little inwards in front of the ilio-sacral symphysis, as far as the upper part of the sciatic notch, where it divides in general into two, and sometimes into three branches; from the point of division, however, a small artery continues forwards to the bladder, and ends in a ligamentous substance, which ascends on the side of this organ to its apex, and thence proceeds along the abdominal muscles to the umbilicus, thus marking the course and situation of the former umbilical artery.

Each iliac artery in this course, that is from its origin to the sciatic notch was covered by peritonæum, and is accompanied by the internal iliac vein, which lies posterior to it; on the right side the vein is also to the external side of the artery; the origin of the pyriformis muscle, and the sacral nerves, as they escape from the anterior sacral foramina are internal, and the communicating branch of the lumbar plexus is posterior to each; the obturator nerve is to the outer side, the ureter crosses at the commencement, and the vas deferens at the ligamentous termination of each. If the student have an opportunity of contrasting the course of this artery in the adult and in the fœtus, he

will find considerable difference to exist in it at these different periods of life. In the adult, the artery passes backwards and downwards deep into the pelvis to the sciatic notch, where it appears to terminate, as its principal branches pass through this opening. The convexity of the arch which the artery forms, looks backwards and upwards towards the ilio-sacral symphysis, from which it is only separated by a vein and nerve; whereas in the fœtus this artery (which is much larger in proportion than in the adult) passes forwards and a little downwards and then upwards; and the convexity of the arch which is thus formed looks downwards and outwards. At this age, this artery can scarcely be considered as contained in the pelvis, but runs nearly parallel to the superior border of this cavity; the branches which it gives off are very small, and the trunk of the artery does not appear diminished in size after their origin.

The trunk of the internal iliac artery is but seldom found diseased, some of its branches, however, may become the seat of aneurism from disease or accident; in such cases, if the branch directly connected with the disease cannot become the subject of operation, it has been suggested, that applying a ligature on the trunk of the internal iliac artery may be attended with good effects; this operation has been performed in two cases of gluteal aneurism, and in one of them with perfect success.\* These cases have established the

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\* See account of a case of gluteal aneurism, *Medico-Chirur. Trans.* vol. v. p. 422; *Med. and Phys. Jour.*, vol. xxxviii. p. 267, also *Guthrie on Injuries of the Arteries.*

practicability of this operation ; as to the facility, however, with which it may be performed, that will greatly depend on the circumstances of the case. Although in the dead emaciated subject a ligature may be easily passed around this vessel, yet in the living subject the attempt must be attended with considerable difficulty, which will be great in proportion to the muscularity and fatness of the individual ; the peritoneum is in great danger of being injured, and I may remark, that in old subjects I have often found it very thin, and easily torn in this situation, so that in attempting to detach it from the artery in practising this operation on the dead body, I have sometimes lacerated this membrane. The ureter in some subjects is very closely connected to this artery ; the internal iliac vein is also intimately attached to it, and the mobility of these vessels adds to the difficulty of separating them from each other, for the operator can only venture to use the fingers of one hand, and no sharp instrument can with safety be employed, on account of the proximity not only of the internal iliac vein, but also of the external iliac artery and its vein. In the dead subject I have experienced less difficulty in tying the common iliac, than the internal iliac artery ; indeed, I feel disposed to prefer the former operation even during life : although the direct supply of blood to the leg and thigh should be thus cut off, yet great reliance may be placed on the lumbar and pelvic anastomoses.

The operation of tying the internal iliac artery may be performed in the following manner : place the patient on his back, and bend the lower extremities on

the trunk, so as to relax the abdominal muscles ; an incision three or four or even five inches long is to be made through the integuments of the lower part of the abdomen parallel to the epigastric artery, that is, in a line drawn from the centre of Poupart's ligament towards the umbilicus. The inferior extremity of this incision may terminate about an inch above Poupart's ligament, so as not to endanger the spermatic chord, and the superior extremity may end at the outer edge of the rectus muscle. The three laminae of the abdominal muscles are next to be cautiously divided on a director to the same extent ; the fascia transversalis may be then torn through with the finger, and the peritoneum can be easily detached from the iliac fossa towards the pelvis : this part of the operation will be facilitated if the patient's bowels have been previously emptied by a smart cathartic. If the finger be now passed to the inner side of the cavity which has been thus formed, the pulsation of the external iliac artery will be felt, and by following this to its origin, or towards the spine, the internal iliac will be discovered lying internal and rather posterior to it, the chord-like feel of the obturator nerve may also assist in guiding the finger to the vessel. The origin of the internal iliac will be found nearly opposite the centre of a line drawn from the anterior superior spinous process of the ilium to the umbilicus. Then with the nail of the index finger, or with the eye of a bent probe, this artery may be separated from its accompanying vein which lies behind, and on the right side a little external to it. The sides of the wound



should now be held asunder by two broad spatulæ, slightly curved, and the aneurism needle can be carried around the internal iliac artery, directing it from within outwards, or towards the psoas muscle, taking care to avoid the ureter and peritoneum internally, and the external iliac vessels externally. If an assistant press these vessels outwards and backwards towards the iliac fossa, they will be more effectually protected, and this part of the operation will be facilitated: the ligature should be applied low down on the trunk, as far from the bifurcation of the common iliac as possible.

A ligature may be passed round the common iliac artery by an operation similar to that now described; this I have frequently practised on the dead subject, and have experienced very little difficulty in effecting it. In a very thin subject a ligature may be passed round the aorta, between the origin of the inferior mesenteric artery and its division into the iliac arteries, without injuring or opening the peritoneum, by making the incisions through the integuments and abdominal parietes in the same direction, and to a little greater extent superiorly than in the operation of tying the internal iliac artery. In the operation of tying the aorta or the common iliac artery, it may be advisable always to make the external incision longer.\* The application of a ligature to the common iliac artery is in the dead subject very practicable, and I should think it must be a very rare occurrence indeed in which this operation may not answer all the pur-

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\* See account of a case in which the common iliac was tied by Mr. Crampton, *Med. Chir. Trans.* vol. xvi. Part 1. p. 157.



poses of a ligature on the aorta itself; indeed, I can scarcely conceive a case in which the latter will be necessary, except in the event of wound of the common iliac, or secondary hæmorrhage after the operation just now described.

The principal branches of the internal iliac artery are nine in number; these may be divided into two sets, an internal, which supply the parts within the pelvis, and an external, which supply the parts external to this cavity. The internal set consist, in the male, of five, namely, the *ileo lumbar*, *middle hæmorrhoidal*, *lateral sacral*, *vesical* and *umbilical*; in the female two more may be added, viz., the *uterine* and the *vaginal*. The external set are four in number, namely, the *obturator*, *gluteal*, *sciatic*, and *puddic*; these are principally distributed to the great muscles which lie external to the pelvis, and are considerably larger than the internal branches.

All these branches are almost always to be found, but as to their origin, they are very uncertain; sometimes the internal iliac artery will give off but two branches, and from these all the others will be derived; and the obturator is found to arise nearly as often from the epigastric artery as from the internal iliac.

The student will find it more convenient to trace these branches according to this arrangement than by classing them into anterior, posterior, internal, and external.

There are few vessels in the body the dissection of which is more troublesome or complicated than that of the internal iliac artery and its branches; it is one,

however, to which the student should devote considerable time and attention, as many important practical inferences may be deduced from a correct knowledge of the relative anatomy of this artery and of its numerous ramifications.

The student may first examine the internal set of branches; to expose these, empty the bladder and rectum, detach the peritoneum from the side of the pelvis, and carefully remove a quantity of loose cellular membrane which lies beneath it, and which contains numerous veins; all the internal branches of this artery may be then exposed by a little dissection without dividing the pelvis. A more satisfactory view, however, of these arteries may be obtained when a section of this cavity has been made; but this can be done with greater advantage at a future stage of the dissection, when some of the external set of branches, particularly those in the perinæum, have been examined.

## I.

### ARTERIA ILIO-LUMBALIS,

ARISES from the external and posterior part of the internal iliac artery, and runs obliquely upwards, backwards, and outwards, to the iliac fossa, where it divides into three sets of branches. In this course the ilio-lumbar artery lies anterior to the ilio-sacral symphysis and to the communicating branch of the last lumbar nerve, and passes behind the external iliac artery and vein, the anterior crural nerve, and the

psoas and iliac muscles; in this part of its course it gives off several small branches which ramify through the substance of these muscles. At the upper and internal part of the iliac fossa, the ilio-lumbar artery divides into several branches, some of which ascend, others descend, and the third pass outwardly.

The ascending branches supply the psoas and quadratus lumborum muscles, anastomose with the lumbar arteries, and with branches from the renal and spermatic; branches also accompany the lumbar nerves into the spinal canal.

The descending branches of the ilio-lumbar artery ramify through the substance of the iliacus internus muscle, some run between it and the bone; a considerable branch may be seen passing into the diploe of the latter by an oblique canal which commences about the centre of the iliac fossa; other branches descend on the surface of the psoas and iliac muscles to the groin, and anastomose with branches of the epigastric and femoral arteries.

The external set of branches of the ilio-lumbar artery are the principal, they pass across the iliac fossa, giving off several arteries to the iliac muscle; some small branches then turn over the crest of the ilium, enter the glutæi muscles, and communicate with branches of the glutæal artery; others run along the inner edge of the crest of the ilium, towards the anterior spinous process of this bone to meet branches of the arteria interna circumflexa ilii, which is derived from the external iliac; small branches also from the ilio-lumbar artery anastomose on the fore part of the

thigh, with the external circumflex artery from the femoral; several arteries also ascend from these external branches of the ilio-lumbar to the abdominal muscles, assist in supplying these and anastomose with the lumbar arteries above, with the circumflex ilii below, and with the epigastric in front. The ilio-lumbar artery, though always present, yet is irregular as to its origin; in some subjects it arises from the gluteal artery, from the sciatic or common iliac, and sometimes the internal iliac artery gives off two branches, answering in their course and termination to the ilio-lumbar.

This artery is important in a practical point of view, as it contributes to maintain several inosculations which must be of essential service when the external iliac artery has been obliterated.

## II.

### ARTERIA SACRI LATERALIS,

ARISES from the inner side of the iliac artery; it very frequently, however, arises in common with the branch last described, and in some cases it proceeds from the gluteal or sciatic arteries. The lateral sacral artery from its origin bends downwards and inwards and descends parallel, but about an inch external to the middle sacral artery as far as the coccyx, it then turns a little inwards and anastomoses with the middle sacral and with the corresponding branch from the opposite side; sometimes this artery enters the second

or third foramen in the sacrum, and terminates in the spinal canal within this bone.

The lateral sacral artery passes over the pyriform muscle and sacral nerves; the sympathetic nerve runs parallel and internal to it between it and the middle sacral artery.

The lateral sacral artery in this course gives off many branches to the pyriform muscle and to the sacral nerves, along each of which small arteries run and entering the foramina in the sacrum are distributed to the dura mater, and anastomose with the different spinal arteries; a few small branches of these may be found on the posterior surface of the sacrum, having escaped through the posterior sacral foramina; these branches anastomose with the gluteal arteries. The lateral sacral artery also gives off branches to the rectum and bladder, and to the surrounding cellular membrane.

The lateral sacral arteries are very irregular; frequently two or three small branches from the sciatic, gluteal, or pudic, supply their place.

### III.

#### ARTERIA HÆMORRHOIDALIS MEDIA.

THIS artery, like the last, is irregular as to its origin; it may be found to arise from the lateral sacral, from the sciatic or pudic arteries, as frequently as from the trunk of the internal iliac. The middle hæmorrhoidal artery passes downwards, forwards and

inwards beneath the peritoneum along the anterior and lateral part of the rectum, and divides into several branches, some of which ascend and inosculate with the superior hæmorrhoidal artery, others descend and communicate with branches of the pudic artery; the hæmorrhoidal artery also sends branches to the fore part of the rectum, some of which are distributed to the bladder, vesiculæ seminales, to the prostate gland in the male, and to the inferior surface of the uterus and vagina in the female. This artery is said to be larger and more regular in the female than in the male. Its place is often supplied by two or three arteries instead of a single vessel.

#### IV.

##### ARTERIE VESICALES,

ARE generally three or four in number; they are very irregular as to their origin, being found to arise indifferently from the sciatic, pudic or hæmorrhoidal or from the trunk of the internal iliac; their branches are principally distributed to the inferior fundus of the bladder; but few arteries are observed on the superior part of this organ.

The vesical arteries may be divided into three sets, the inferior, middle, and superior. The first are derived from the hæmorrhoidal, pudic and sciatic; the superior are given off from the umbilical branch; and the middle vesical artery in general arises from the internal iliac, near its ligamentous termination, but



very frequently from some of its branches. The middle vesical artery usually accompanies the ureter to the bladder, and there divides into numerous branches, which ramify between the coats of this viscus in all directions, and anastomose with the other arteries which supply this organ, and with corresponding branches from the opposite side. The inferior vesical artery, or the branches corresponding to it are larger and more numerous, at least in the adult and old person, than either the middle or superior vesical arteries; hence the neck and inferior fundus or region of this viscus are more vascular than any other regions. In the course of this dissection of the inferior vesical arteries, the student cannot fail to observe the great number of veins in this region; these veins come from different sources, some from the perinæum, some from the penis, others from the prostate and vesiculæ seminales, in the vicinity of the latter they form plexuses with which the veins of the rectum and surrounding fat communicate; these veins are very large and numerous in the adult, they all communicate directly or indirectly with the internal iliac veins.

## V.

### ARTERIA UMBILICALIS.

THIS in the fœtus is the continuation of the internal iliac artery, and appears to have given off all the pelvic branches; it bends upwards, forwards and inwards along the side of the bladder, and then ascends behind

the abdominal muscles to the umbilicus, enclosed in a fold of peritonæum which connects it to the urachus, and to the opposite artery. In the adult, however, it is very small, although its coats are thick : it is seldom pervious beyond the side of the bladder, and there it ends in a ligamentous substance ; this artery gives off several branches to the bladder, which principally ramify on the side and posterior part of this organ ; these branches anastomose with the other vesical arteries, and with the corresponding branches from the opposite side.

## VI.

### ARTERIA UTERINA.

THIS artery arises from the internal iliac after the middle hæmorrhoidal ; it very frequently arises from the pudic ; the uterine artery, though small, is remarkably tortuous, it passes forwards and inwards, runs between the laminae of the broad ligament to the inferior part of the side of the uterus, where it divides into a number of branches ; these also are very tortuous, many of them appear to increase in size as they are entering the structure of this organ ; these branches then ramify through the parietes of the uterus in every direction, and anastomose with their corresponding arteries from the opposite side. Some branches of the uterine artery also descend to the vagina, some pass forwards to the bladder, and others ascend in the broad ligament to the Fallopian tubes and to the ovaria, and inosculate with the spermatic

arteries, branches of the abdominal aorta. The uterine arteries and their branches are greatly enlarged during pregnancy or in diseases of the uterus. The uterine arteries in a foetal and adult pelvis, when contrasted, present a very remarkable difference as to size.

## VII.

### ARTERIA VAGINALIS

ARISES from the iliac, next to the last described branch, but frequently from it or from the pudic or sciatic artery ; it runs along the anterior and lateral part of the vagina towards the perinæum, distributing its branches in this course to the bladder, vagina, and rectum, its ultimate branches anastomose with those of the pudic artery.

The student may now proceed to examine the next order of branches of the internal iliac artery, namely, those which pass out of the cavity of the pelvis, and which are principally distributed to the muscles which are situated on its parietes ; these branches are four in number, namely, the *obturator*, *gluteal*, *sciatic*, and *pudic* ; of these branches one escapes from the pelvis by the thyroid foramen, three by the sciatic notches.

## I.

### ARTERIA THYROIDEA VEL OPTURATORIA.

THIS artery is very irregular in its origin, it more frequently arises from the anterior part of the internal iliac artery, but sometimes from one of its branches,

and it very frequently proceeds from the epigastric artery, a branch of the external iliac, and it often has a double origin, one from the epigastric, and the other from the internal iliac artery, both unite near the thyroid foramen: we sometimes observe, that it has a different origin on the opposite sides of the same subject. When the obturator artery arises from the internal iliac, or from one of its branches, it runs forwards and downwards to the upper part of the thyroid foramen, through which it passes into the groin, and is then distributed to the muscles at the inner side of the thigh.

The student may first examine the connexions of this artery in the pelvis, afterwards in the thigh. As the obturator artery runs from its origin to the thyroid foramen, it lies parallel and inferior to the external iliac artery and vein, superior to the origin of the levator ani muscle, and surrounded by some loose cellular membrane which connects it to the bladder; it is accompanied by the nerve of the same name, the latter lying superior to the artery. In this course the obturator artery gives off several small branches, internally, to the bladder, these communicate with the different arteries of this organ; and externally, to the side of the pelvis, to the psoas muscle, and to the lymphatic glands; these arteries anastomose with branches of the external iliac artery. When the obturator artery arrives near the thyroid foramen, it perforates the pelvic fascia, the superior border of the levator ani, and of the obturator muscle; to these muscles it sends several small arteries; at the thyroid opening it gives off two or three considerable branches, which run

along the internal border of this opening, and are principally distributed to the obturator muscle; some branches also pass more inwardly to the neck of the bladder, supply the cellular membrane behind the pubis, and anastomose with corresponding arteries from the opposite side: I have occasionally seen a considerable branch pass in this direction, to the sides of the prostate gland and thence to the perinæum, to supply the place of some deficient branches of the proper pudic artery. Other branches of the obturator artery pass upwards and outwards, and communicate with the epigastric artery. The obturator artery, veins, and nerve, then pass through the upper part of the thyroid foramen; the passage for these resembles an oblique canal, which is bounded below by the obturator ligament and muscles, and above by the ramus of the pubis, which is grooved in an oblique direction; this peculiar form of the canal must tend as a security against the occurrence of hernia in this situation: should such however take place, the vessels must lie upon the superior and external surface of the sac.

The obturator artery then descends into the thigh; to expose it here, the student should divide the pectineus, and the upper extremity of the adductor longus; these muscles should be carefully cut through by small portions only at a time, so as to avoid injuring the branches which they receive. The obturator artery having passed through the thyroid foramen, lies on the obturator externus muscle, and divides into two principal branches, a posterior or external, and an anterior or internal; the former inclines backwards along

the external margin of the obturator foramen, and divides into several branches, which pass in different directions; two or three of these run along the border of this opening, and supply the external obturator, the adductor magnus, quadratus femoris, and the hamstring muscles; one or two small branches pass outwards, and enter the acetabulum by the notch, which is placed at the lower and internal part of this cavity: these branches sometimes arise from the internal circumflex artery; they are distributed to the fat and cellular membrane within the joint, and some of them are conveyed along the interarticular ligament to the head of the femur.

The anterior division of the obturator artery is the larger of the two, it descends between the adductor brevis and longus, and divides into several branches, which are distributed to the muscles at the inner side of the thigh; these branches inosculate freely with the internal circumflex artery, a branch of the femoral; some branches also from the obturator artery pass through the upper extremity of the adductor muscles, and run towards the perinæum and scrotum, and anastomose with branches of the pudic artery; several long branches descend beneath the gracilis and adductor longus, accompanied by the branches of the obturator nerve; these descending branches partly supply the muscles in this situation, and communicate with branches of the femoral and profunda arteries.

These several inosculations between the femoral and obturator arteries, have some analogy to the inosculations that exist between the arteries about the



scapula, and must be of essential service in conveying blood from the internal iliac to the femoral artery, in case the external iliac has been obstructed, and provided the obturator has been derived from the internal iliac artery.

The obturator artery is found to arise from the epigastric so frequently, that the student should consider the course it must take from such an origin to arrive at the thyroid foramen; the relative anatomy of this artery in cases of this variety is very important, and should be particularly attended to, for, in the event of femoral hernia existing, the neck of the sac may be found almost encircled by this vessel. When the obturator artery thus takes its origin from the epigastric, it turns in a tortuous manner inwards and downwards, crossing the crural or femoral ring, sometimes along its posterior border; it then bends down behind the ramus of the pubis, and escaping by the upper part of the thyroid foramen, descends into the thigh, where it terminates in the usual manner. When this artery passes along the anterior part of the femoral ring, and then descends along its internal side, it may be considered as bounding three-fourths of the circumference of this opening, and should hernia exist, the artery will have the same relation to the neck of the sac; in such a case there must be considerable danger of injuring this vessel in dividing Gimbernaut's ligament; it is not, however, always, indeed I believe it is very seldom necessary to separate this ligament from the pubis, for the fascia lata is so much concerned in the structure of this part, that dividing this aponeurosis at the inner

side of the neck of the sac, where it is continuous with Gimbernaut's ligament, will be found in almost every instance sufficient to enlarge the opening, or to relax its inner and anterior part sufficiently to admit of the reduction of the intestine.

Should the obturator artery, when it thus arises from the epigastric, pass along the external and posterior borders of the crural ring, it will not be endangered in the operation for femoral hernia, as it must lie behind the neck of the sac.

## II.

### ARTERIA GLUTEA,

Is the largest branch of the internal iliac artery, in the adult it appears as its continuation: it arises from the posterior part of this trunk, and runs downwards, backwards, and outwards, through the sciatic notch, forming an arch the convexity of which is directed downwards; it then divides into several branches to supply the gluteal muscles.

The origin of the gluteal artery is covered by the internal and external iliac arteries and veins, also by a large nerve, the communicating branch of the lumbar plexus, which joins the first sacral nerve, sometimes the upper division of this plexus also conceals this artery. Very soon after its origin this artery passes through the sciatic notch, accompanied by the superior gluteal nerve and vein, it turns round the

ilium at the upper and anterior part of this opening, and above the pyriform muscle.

The principal branches of the gluteal artery are distributed to the muscles on the dorsum of the ilium; it seldom gives off any branch of importance while within the cavity of the pelvis; sometimes, however, the ileo-lumbar, lateral sacral, or the middle hæmorrhoidal arteries, arise from this trunk; it also generally gives off a few branches to the pyriform muscle, and to the ilio-sacral articulation.

To expose the gluteal artery, and its branches on the dorsum of the ilium, the subject should be placed on the face or side, and the knee and toes turned inwards; an incision may then be made through the integuments from the upper part of the sacrum to the great trochanter, the surface of the glutæus maximus and medius muscles may be then dissected clean; next divide the glutæus maximus in a line from the posterior superior spinous process of the ilium to the tuberosity of the ischium. In making this dissection several large veins and arteries must be injured; if the edges of this muscle be now separated, and the subjacent cellular membrane removed, the trunk of the gluteal artery, accompanied by one or two large veins, and by the gluteal nerve, may be seen escaping from the sciatic notch, above the pyriform muscle, and between it and the glutæus medius. The gluteal artery, as it emerges from the pelvis lies three inches and a half from the mesial line, or from the spinous processes of the sacrum. This artery now appears like a short trunk or axis, for it immediately divides

into two principal branches, a *superficial* and a *deep* one; these soon subdivide into numerous arteries, which separate and run in a radiated direction: most of these branches appear to rise together, and at first lie almost close to the bone, but they are soon separated into different planes by the muscles on the dorsum of the ilium. The principal branches of the gluteal artery are directed forwards and downwards; a few, however, pass backwards, towards the sacrum and coccyx: these posterior branches, although some of them are of considerable size, have received no particular name.

1. RAMUS SUPERFICIALIS, runs from the sciatic notch upwards and outwards, between the glutæus maximus and medius muscles, and soon divides into several arteries; some of these run towards the sacrum and coccyx, pierce the attachment which the glutæus maximus has to those bones, and divide into different branches; some of which run superficially to the muscles and integuments; others pierce the ileo-sacral ligaments, and ramify on the back part of the sacrum and coccyx; some of these branches are very large, and anastomose with the pudic and sciatic arteries, and with the perforating branches of the lateral sacral. The superficial branch of the gluteal artery sends several branches also forwards and downwards, in the substance of the glutæus maximus muscle; many of these are long and large, they frequently inosculate with each other, and with arteries which perforate the glutæus medius muscle from the deep branches of the gluteal artery.

2. *RAMUS PROFUNDUS* is the principal branch of the gluteal artery; it passes upwards and forwards between the glutæus medius and minimus, and soon divides into four or five branches, one or two immediately pass into the substance of the ilium: the others may be arranged into three principal sets, a superior, middle, and inferior. The first, consisting of two or three branches, pass forwards in an arched manner towards the anterior spinous process of the ilium, covered by the glutæus medius, and coursing along the convex origin of the glutæus minimus muscle: to both these muscles they send numerous branches; some of these anastomose with those branches of the ileo-lumbar and circumflex ilii arteries, which turn over the crest of the ilium, others communicate near the anterior spine of the ilium, with the external circumflex branches of the femoral artery.

The second, or middle set, in general consist of two considerable arteries, which also run forwards and downwards towards the anterior part of the great trochanter; these are also covered by the glutæus medius, and run across the centre of the glutæus minimus: to both these muscles they distribute numerous branches, and at their anterior margin they inosculate with ascending branches from the external circumflex artery from the femoral. This inosculature may be exposed by dividing the tensor vaginæ femoris, and removing some cellular membrane from between the anterior edge of the glutæus medius and the rectus femoris muscles.

The third, or the descending branch, passes paral-

lel to, but inferior and deeper seated than those last described; this branch runs at first on the glutæus minimus, but soon piercing this muscle, it lies on the ilium, immediately above the capsular ligament of the joint; it then runs towards the anterior inferior spinous process of the ilium, and anastomoses with the external circumflex artery; in its course this artery gives off several branches to the gluteal muscles, to the substance of the ilium, and to the capsular ligament.

The gluteal artery is very regular in its course, and in the general termination of its branches: as it escapes from the sciatic notch, it is covered by the glutæus maximus muscle, and lies at such a depth from the surface, that it is not liable to injury; some of its branches, however, or even the trunk itself, may be divided in punctured or gunshot wounds in this region. Mr. J. Bell relates a case of aneurism of the trunk of this artery, which increased to an extraordinary size. Mr. Bell laid open the sac to a great extent, and then secured the mouth of the gluteal artery with a ligature;\* in such a case it would be impossible to expose the trunk of this vessel without opening the sac, for it divides into its different branches at the very margin of the sciatic notch.

We can, nearly, ascertain the position of the gluteal artery on the dorsum of the pelvis, by drawing a line from the posterior spinous process of the ilium, to the midspace between the tuberosity of the ischium and

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\* See *Bell's Principles of Surgery*, vol. i. p. 421.



the great trochanter ; if we divide this line into three, we shall find the gluteal artery emerging from the pelvis at the juncture of its upper and middle thirds.

To expose this artery in the living subject, we should place the patient on his face, turn the toes inwards, and commence an incision about one inch below the posterior spinous process of the ilium, and about an inch external to the side of the sacrum continue this incision for about three inches in an oblique direction towards the great trochanter, through the integuments and subjacent cellular membrane down to the glutæus muscle, then separate the fasciculi of this muscle in the same direction, and to the same extent as the external wound, it may be requisite to divide a few of its fibres ; let the sides of the wound be then separated by two broad retractors ; a dense aponeurosis, which will next appear, must be freely divided or torn through with the finger, and the branches of the gluteal artery will be exposed ; by separating some loose cellular membrane, the trunk of the artery may be seen escaping through the upper and anterior part of the sciatic notch, and lying close to the bone ; a curved aneurism needle may be then passed under the artery, and care should be taken not to include the surrounding nerves and veins in the ligature. In a fat or in a very muscular person this cannot be an easy operation, on account of the great depth at which the artery lies from the surface, the unyielding nature of the surrounding parts, and the numerous vessels that must be cut during the operation, the bleeding from which will so obscure the view of the deep-seated

parts, as to render it difficult to distinguish one structure from another. I conceive this operation is only advisable in cases of wounds, or of aneurism the consequence of these: under either of these circumstances, I should prefer this operation to that of tying the internal or the common iliac artery, notwithstanding the latter practice has been recommended by very high authority.

### III.

#### ARTERIA ISCHIADICA,

ARISES from the internal iliac artery, anterior to the gluteal; it passes through the inferior part of the sciatic notch, between the pyriform and levator ani muscles, and is distributed to the muscles on the back of the ilium, and to those at the upper and back part of the thigh.

The sciatic artery is smaller than the gluteal, yet it often appears as the continuation of the internal iliac; it has a longer course in the pelvis than the gluteal artery. The sciatic artery from its origin runs downwards and forwards over the pyriform muscle and the sciatic plexus of nerves, it then escapes through the lower part of the sciatic notch, between the pyriform and levator ani muscles, above the lesser sciatic ligament, and in front of the great sciatic nerve; it sometimes passes between the roots of this nerve.

On the dorsum of the pelvis the sciatic artery is covered by the glutæus maximus muscle, but it may

be seen in the same dissection as was made to expose the last described artery. The sciatic artery then descends in the fossa between the trochanter and tuber ischii, but nearer to the latter, and about half an inch to the internal or sacral side of the sciatic nerve : it preserves the form of a trunk but for a short distance, and soon divides into several branches, which are distributed to the muscles in this situation.

While in the pelvis, the sciatic artery sends some small branches to the pyriform and levator ani muscles, to the rectum and bladder, vagina and uterus, and to the surrounding cellular membrane ; it very frequently gives off the middle hæmorrhoidal and lateral sacral arteries : the sciatic and pudic also often arise by a common trunk.

When the sciatic artery has passed through the sciatic notch, it sends off several branches in different directions ; some of these pass inwardly towards the sacrum and coccyx, others are distributed to the glutæus maximus muscle, but the principal descend on the back part of the thigh, and supply the hamstring muscles, the quadratus femoris, and the adductor magnus. The principal branches of the sciatic artery may be considered as three in number, 1st, *ramus coccygæus* ; 2nd, *comes nervi ischiadici* ; and 3rd, *rami musculares*.

1. *RAMUS COCCYGÆUS*. This is a very large and regular branch ; it sometimes appears like a subdivision of the sciatic artery. The coccygeal artery runs inwards and downwards across the pudic artery, pierces the sacro-sciatic ligaments, sends some branches to the posterior surface of the sacrum and coccyx,

which anastomose with the posterior branches of the lateral sacral arteries. The coccygeal artery also supplies the glutæus maximus, and the adipose substance around the extremity of the rectum; these branches communicate with the pudic and hæmorrhoidal arteries.

2. COMES NERVI ISCHIADICI. This branch arises opposite the tuber ischii, and takes the course of the sciatic nerve; at first it is but loosely connected to it, but it soon penetrates to its centre, and descends in it to the lower part of the thigh; here this artery is sometimes found larger than it was above, and divides into branches which correspond to the divisions of the nerve. In this course the comes nervi sciatici has frequent communications with those different branches of the femoral artery which supply the muscles on the back part of the thigh. In addition to this artery, several small branches, from different sources, accompany the sciatic nerve, and form numerous inosculations, which, in a minutely injected subject, present a spiral appearance along its whole course: I have found these spiral inosculations large and numerous, and very tortuous, in a limb in which the femoral artery had been obliterated many years previously.

3. RAMI MUSCULARES. Between the tuberosity of the ischium and the great trochanter the sciatic artery divides into several branches, some of which terminate in the lower part of the glutæus maximus muscle, others descend to the biceps, semi-membranosus, and semi-tendinosus; these branches anastomose with the perforating arteries of the arteria profunda femoris. The other muscular branches of the

sciatic pass deeper than the former, supply the gemini, the obturator and the quadratus femoris muscles; between the inferior edge of this last, and the superior edge of the adductor magnus, two or three branches of the sciatic artery inosculate with the circumflex arteries from the femoral.

The inosculations between the sciatic and femoral arteries must co-operate with those already mentioned in the description of the obturator and gluteal arteries in conveying blood to the lower extremity, in the event of the external iliac artery being obliterated. The sciatic artery emerges from the pelvis about two inches inferior to the gluteal artery, and a quarter of an inch internal to it, or nearer to the sacrum; it is about three inches distant from the mesial line of the sacrum. If a line be drawn from the posterior spinous process of the ilium, to the inferior or most prominent part of the tuberosity of the ischium, the sciatic artery will be found nearly opposite to or a little below the centre of this line. If this perpendicular line be made to terminate at the upper part of the tuberosity of the ischium, then the sciatic artery will be found at its exit from the pelvis, opposite the upper part of the inferior third of this line.

The sciatic artery may be exposed in the living subject by placing the patient in the same position, and dividing the integuments and the glutæus maximus muscle to the same extent and in a similar direction, but about an inch and a half inferior to that recommended in the operation of tying the gluteal artery. The remarks which have been offered when

speaking of the latter operation will apply to the present case.

#### IV.

##### ARTERIA PUDICA INTERNA,

ARISES in general from the internal iliac artery immediately after the sciatic, but very frequently both these arteries proceed from the internal iliac by a common trunk, which soon subdivides; sometimes, however, this trunk does not give off the pudic until it has passed out of the pelvis through the sciatic notch.

The pudic artery is smaller than the sciatic, it accompanies this vessel out of the pelvis through the great sciatic notch, lying internal and anterior to it; the pudic artery then runs for a short distance on the dorsum of the pelvis, covered by the great sciatic ligament, and by branches of the sciatic artery. The pudic artery then re-enters the pelvis through the lesser sciatic notch, and runs forwards and upwards on the inner side of the tuberosity and ramus of the ischium, and along the edge of the ramus of the pubis, to nearly as high as the pubic ligament, and there terminates by dividing into two branches, one to supply the corpus cavernosum, the other the dorsum of the penis.

The pudic artery in this course forms an arch the convexity of which is directed backwards, the concavity forwards, and the most prominent part of the arch is that portion which is external to the pelvis, and be-



tween the two sciatic notches. In the erect position the pudic artery at first descends almost vertically, it then runs upwards and forwards, converging anteriorly (or at the pubis) to its fellow of the opposite side.

For the purpose of more attentively examining the relative anatomy of this artery, the student may divide its whole course into three stages; the first is within the pelvis, and extends from the origin of the artery to the lower margin of the sciatic notch; this portion of the pudic artery will be wanting in those cases where the sciatic does not give it off until it has passed out of the pelvis. The second includes that short portion of the artery which is external to the cavity of the pelvis, and which extends from the superior to the inferior sciatic notch. The third stage is the longest, and extends from its re-entrance into the pelvis to its termination at the arch of the pubis.

The pudic artery, in the first division of its course, is of very uncertain length, being much longer in some than in others, according as it arises from the internal iliac high in the pelvis, or from the sciatic low down in this cavity. In this part of its course, the pudic artery is surrounded by a quantity of loose cellular membrane; it descends in a tortuous manner behind the bladder and vesiculæ seminales, and in front of the pyriform muscle and sciatic nerve; it lies nearly parallel to the sciatic artery, but internal and anterior to it; it then passes out of the inferior part of the great sciatic notch, internal, or nearer to the sacrum than the sciatic nerve and artery, but partly concealed by the branches of the latter.

The pudic artery in this part of its course gives several small branches to the bladder, rectum, and vesicuke seminales: the middle hæmorrhoidal also frequently arises from it. In the female several branches proceed from it to the uterus and vagina.

The pudic artery may be exposed in the second stage of its course, by dividing the posterior part of the glutæus maximus musele in the same manner as was directed in the description of the two last described arteries; some cellular membrane on the inner side of the sciatic nerve and artery must be then removed, and the external edge of the great sciatic ligament must be cut through. In this part of its course the pudic artery runs obliquely from the lower edge of the pyriform musele, downwards and inwards, over the spinous process of the ischium, and passes through the lesser sciatic notch, accompanied by the pudic nerves and veins. The tendon of the obturator internus muscle passes out of this notch as the pudic artery enters; the tendon lying external to the artery, or nearer to the ischium.

The pudic artery in this situation gives two or three branches to the sciatic ligaments, and to the tuber ischii, to the glutæus maximus, gemini and obturator museles, also to the sacrum and coccyx; these branches anastomose with the sciatic and gluteal arteries.

In cases of hæmorrhage from the branches of the pudic artery in the perinæum or penis, I have known some benefit arise from the patient lying on his back on a hard bed, or on a board, with a small piece of cork or wood placed behind each spinous process of

the ischium, so as to press the pudic artery against that point of bone; this position can be borne for a considerable time without much inconvenience.\* In the living subject we can ascertain the situation of the pudic artery, by attending to the following directions: place the individual on his face with the lower extremity extended, and the toes turned inwards; feel for the summit of the great trochanter, and for the base, or articulated end of the os coccyx; these two points are on a level; then draw a line from one to the other, and we may be certain that the pudic artery and the spine of the ischium are opposite the junction of the middle and internal thirds of this line, about an inch and a half above the most prominent part of the tuberosity of the ischium, and about two inches from the side of the coccyx.

In a thin person it might be practicable to pass a ligature around the pudic artery in this situation: the patient should be placed in the position above-mentioned; divide the integuments and subjacent cellular membrane by an incision about three inches in length; this should commence about an inch external to the side of the fourth piece of the sacrum, and be continued in an oblique direction towards the root of the great trochanter, that is parallel to the fibres of the

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\* I first saw this expedient resorted to by Mr. Travers, in St. Thomas's Hospital, in a case of sloughing ulcer in the glans penis in a very emaciated individual; in that case the hæmorrhage was very alarming, and pressure was applied in the manner I have mentioned, and with a decided good effect, when all local applications to the ulcer had failed.

glutæus maximus. The fasciculi of this muscle must then be separated in the direction of the first incision ; it may be necessary to cut across some fibres of this muscle. The external edge of the great sciatic ligament must be next divided, and a dense fascia which is continued from it, and which conceals and renders difficult the clean dissection of any of these arteries on the dorsum of the pelvis. The coccygeal branch of the sciatic artery will be thus exposed, and may be mistaken for the pudic artery, which, however, is deeper seated ; this branch should be tied and divided. If the finger be now passed to the bottom of the wound, the spine of the ischium may be felt ; the pudic artery lies near the point of this process ; with the handle of the knife or any blunt instrument this vessel may be separated from its connexions, and if the sides of the wound be held separate, the curved aneurism needle may be passed round the artery ; care should be taken not to include the pudic nerves.

The foregoing rules for ascertaining the situation of this and of the gluteal and sciatic arteries, at their exit from the sciatic notch, are given chiefly as points to fix the attention of the dissecting pupil, and not by any means under a conviction of their constant and practical applicability during life. The points of anatomical reference which are selected, are not always sufficiently prominent or distinct to render the measurement of the intervening spaces perfectly accurate ; this circumstance, however, the operating surgeon will perhaps have but little cause to regret, when it is recollected, that the operations of tying these arteries

on the dorsum of the pelvis, are alone required in cases of recent wounds or of aneurisms the consequence of wounds. In instances of the former, the direction of the wound will in general serve as the most certain guide to the situation of the divided vessel, and should be preferred to any fixed rule. In aneurisms which will in general be more or less diffused, the relative position of the parts will, in all probability, be so much altered, that it will be found advisable to cut into the sac at once, to clear out the coagula and secure the bleeding vessel with a strong curved needle; the tenaculum or forceps will not I fear avail much, particularly in aneurism of the gluteal artery. Some advise us in such aneurisms to secure the trunk of the internal iliac artery at once, in preference to any attempt to render the operation nominally more simple, by searching for those secondary branches which may be the seat of the disease: although this opinion has been very generally inculcated, and particularly in Mr. Guthrie's late work on Injuries and Diseases of Arteries, I cannot give an unqualified assent to it. The operation of tying the internal iliac artery is no doubt very practicable, but all must admit there is both difficulty and danger attending its execution, as well as in the subsequent stages. I have elsewhere remarked, that diffused aneurisms, the consequence of wounds, are very generally successfully treated by opening the tumour freely, and tying the artery both above and below the wound, or as in the case of the gluteal artery, which, on the dorsum of the pelvis is like a short axis, securing the very wound itself in the



ligature. I have known this practice to succeed in cases of gluteal aneurism, and should therefore recommend it previous to tying the internal iliac, which I would only have recourse to as a “dernier ressource.”

The pudic artery having re-entered the pelvis now commences its third stage; this extends from the lesser sciatic notch to the arch of the pubis. This division of the artery is most important in a practical point of view, and should be examined by the student with great attention. The dissection of this portion of the pudic artery may be made in different ways; as the subject lies on the face, the artery may be traced from the sciatic notch along the inside of the tuberosity and ramus of the ischium and pubis, and its principal branches may be thus exposed. I prefer, however, the following method: place the subject in the same position as in the lateral operation for lithotomy, or, as in making the ordinary dissection of the perinæum; fill the lower extremity of the rectum with sponge or curled hair, pass a staff into the urethra, raise the scrotum towards the abdomen, and secure it in that position by a stitch, if the student have no companion to assist him. Make an incision through the integuments of the perinæum from the scrotum to the front of the anus, then around each side of this opening to its back part, and continue it in a straight direction to the coccyx: the skin being now dissected to either side, the cutaneous sphincter and the strong superficial fascia of the perinæum are exposed; this fascia may be divided in the middle line, or detached from the rami of the ischium and pubis on one side,



and raised towards the opposite; the muscles of the perinæum are then partly exposed, being still covered by a very fine and semi-transparent aponeurosis.

In the posterior part of the perinæum is the lower extremity of the rectum, on either side of which is a considerable quantity of adipose substance, filling up the space between the intestine and the tuberosity of the ischium; if the student carefully remove this fat, he will bring into view the side of the rectum and the levator ani muscle, passing from the inside of the pelvis obliquely downwards, to be inserted into this intestine; external to this he may observe the obturator fascia descending along the inside of the ischium to be inserted into the great sacro-sciatic ligament, and ramus of the ischium and pubis; this fascia covers the pudic artery in this situation; several perforations may be observed in it for the transmission of some of the branches of this vessel.

The pudic artery is conducted from the lesser sciatic notch towards the perinæum, by a process of the great sacro-sciatic ligament, which extends from the tuberosity along the ramus of the ischium as far as the crus penis. The pudic artery in this course lies at first between the obturator internus muscle and the fascia of that name; the muscle separates the artery from the bone, and the fascia divides it from the levator ani muscle, and from the cavity of the pelvis. The obturator fascia is in this situation very tense, as it is connected to this process of the great sciatic ligament, as far forwards as the ramus of the ischium, or as far as the base of the triangular ligament of the urethra

indeed this ligament appears as the continuation of the obturator fascia, from one side of the pelvis across the perinæum to the other.

As the pudic artery runs in this course it is confined in a sort of canal, which is formed internally, or towards the pelvis, by the obturator fascia, externally by the tuberosity and ramus of the ischium, and inferiorly or towards the perinæum by this process of the great sciatic ligament. As the pudic artery runs along the inside of the tuberosity of the ischium, it lies about an inch and a half above the lower surface of this process, and about two inches and a half from the integuments. From the tuber ischii to the crus penis, the pudic artery is, in some degree, defended by the obturator fascia in the lateral operation of lithotomy, from the edge of the knife or of the gorget.

The student should now reflect, that, in the lateral operation of lithotomy, it is in this situation, between the rectum and ischium, that the operator must clear a passage for the extraction of a calculus, and that the middle portion of the levator ani muscle must be there divided; and if he consider the position of the rectum on one side, and of the pudic artery on the other, he will perceive the necessity of lateralizing the knife to such a degree, as to avoid injury to either of these important parts; for if the cutting edge be directed too much outwards, the artery will be endangered; or if it be turned directly backwards, the rectum must be wounded.

The pudic artery in this division of its course gives branches to the lower extremity of the rectum, to the

muscles and integuments of the perinæum, and to the penis and urethra; these branches are, 1st, *arteriæ hæmorrhoidales externæ*; 2nd, *arteria perinæi*; 3rd, *arteria transversalis perinæi*; 4th, *arteria transversa profunda vel arteria corporis bulbosi vel corporis spongiosi urethræ*; 5th, *arteria corporis cavernosi penis*; and 6th, *arteria dorsalis penis*.

1. ARTERIÆ HÆMORRHOIDALES EXTERNÆ.

These arteries are two or three in number; they arise from the pudic artery soon after it re-enters the pelvis, as it runs along the inside of the tuberosity of the ischium; these arteries pierce the obturator fascia, and pass transversely towards the anus, one anterior, another posterior, and sometimes a third to the side of this opening.

The external hæmorrhoidal arteries give numerous branches to the fat, which fills the space between the tuberosity of the ischium and the side of the rectum; some branches also turn over the tuber ischii to the glutæus maximus muscle, and communicate with the gluteal arteries.

The external hæmorrhoidal arteries supply the lower part of the rectum, and anastomose with each other, and with the corresponding arteries of the opposite side; several branches also ascend along the rectum, and meet the descending branches of the middle and superior hæmorrhoidal arteries.

The external hæmorrhoidal arteries are liable to be divided in the operation for fistula in ano and in lithotomy; however, they soon retract within the surround-

ing cellular membrane, and seldom bleed to any alarming degree.

2. *ARTERIA PERINÆI*. This is a very regular artery, and of very considerable length ; it supplies the muscles and integuments of the perinæum.

The perineal artery arises from the pudic, anterior to the branches last described, it immediately pierces the obturator fascia, and the posterior edge or base of the triangular ligament of the urethra, and descends to the perinæum ; it then turns upwards and forwards round the transverse muscle of the perinæum, and having entered the triangular space between the accelerator urinæ, and compressor penis muscles, it runs forwards and towards the middle line, supplying the muscles and integuments of the perinæum and scrotum ; in which last mentioned part it is ultimately distributed.

In the first part of this course, that is, in the posterior part of the perinæum, the perinæal artery lies very deep, but anteriorly it becomes very superficial this artery throughout its whole course is accompanied by two or three nerves, branches of the pudic ; it sends off several branches to supply the muscles and integuments of this region ; some of these pass towards the mesial line, and anastomose with the corresponding arteries from the opposite side ; others run outwardly over the rami of the ischium and pubis, and communicate with branches from the inside of the thigh. When the perinæal artery has arrived at the scrotum it divides into numerous small but long branches, which ramify in the integuments and sub-

adjacent cellular tissue, which in this region appears to possess a peculiar organization. These branches are accompanied by several nerves and veins ; these latter are very tortuous, and form a complete network in the dartos ; these may be seen during life through the integuments, particularly if the scrotum have been distended by hydrocele, or disease of the testicle ; these terminating branches of the perinæal artery inosculate with several small but long branches which proceed from the femoral, obturator, and spermatic arteries.

The perinæal artery is liable to be cut in lithotomy ; it may escape by chance, but not by any caution or dexterity on the part of the operator ; should it bleed freely, it can be tied without much difficulty, as it lies superficial in the perinæum.

3. ARTERIA TRANSVERSALIS PERINÆI, is a smaller artery than that last described, from which too it frequently arises. The transverse artery of the perinæum in general arises from the pudic immediately after the perinæal artery, it then pierces the obturator fascia and the base of the triangular ligament, descends to the perinæum, and arriving at the transverse muscle, runs along its cutaneous surface, towards the middle line, where it meets the corresponding artery of the opposite side. The transverse artery runs anterior to the anus and posterior to the bulb of the urethra ; its branches are distributed to the different muscles of the perinæum, and anastomose with the perinæal and hæmorrhoidal arteries.

In the lateral operation of lithotomy, this artery must be divided ; in general, however, it is so small

and throws out so little blood, as not to require a ligature.

4. *ARTERIA CORPORIS BULBOSI VEL SPONGIOSI URETHRÆ.* This artery, which is larger than that last described, but very short, arises from the pudic artery when that vessel has arrived at the crus penis, and opposite the bulb of the urethra. The artery of the bulb then runs in a transverse direction, between the fibres of the triangular ligament; about a quarter of an inch above the base of this ligament, and at the side of the bulb, (where the triangular ligament is separating into its two laminae, the anterior of which is connected to the bulb, and the posterior to the membranous part of the urethra), it divides into two branches. One of these descends a little, and enters the anterior prostate gland, or the gland of Cowper; the other branch, which is much larger, pierces the bulb and ramifies through the corpus spongiosum urethrae; its branches open into the cells of this tissue, and some extend as far forwards as the glans; small branches also perforate the fibrous covering of the urethra, and penetrate the corpora cavernosa penis, others go to the muscles and integuments of the urethra and penis.

In performing the lateral operation of lithotomy, the artery of the bulb is in danger of being wounded at the time of dividing the membranous part of the urethra; this accident may be attended with very severe and alarming hæmorrhage; and which it is sometimes very difficult to restrain, for this artery lies very deep, is surrounded by the triangular ligament, the



fibres of which being very dense and unyielding, prevent the divided vessel retracting freely; its origin from the pudic too is so close to the wounded part that it may bleed profusely. In such a case it is almost impossible to apply a ligature on this vessel with the tenaculum; the common dissecting forceps may prove a more convenient instrument, with which to seize and draw out the wounded artery; I have, however, seen it necessary to use the curved needle, and so include the surrounding parts in the ligature.

This artery does not, in every case in which it has been opened, bleed much at the time of the operation; but in a few hours afterwards the patient may complain of a sensation of weight and uneasiness about the rectum and at the wound, also an inability to pass urine, with a strong desire to do so; in addition to these distressing symptoms he becomes cold, pale, and faint; in such a case the surgeon may find it necessary to place the patient nearly in the same position he was in during the operation, and re-open the wound; he should next remove the coagula of blood which fill the cavity of it, as well as those which extend into the bladder; he should then search for the bleeding vessel; it may perhaps be only some small artery between the muscles, which, by bleeding internally; has given rise to such unpleasant symptoms; if so, it can be easily secured with the tenaculum and ligature: but if the artery of the bulb have been wounded, it lies so deep that it will be almost always necessary to have recourse to the curved needle: should this fail to repress the hæmorrhage, we must rely on the effects of

pressure ; in such a case graduated compression applied from the bottom of the wound will not prove effectual, for the fibres of the triangular ligament will not only bear off the pressure from the wounded vessel, but may also have the injurious effect of directing the blood into the bladder, and of confining blood and urine in this reservoir. The pressure should, therefore, be so adapted, as while it compresses the artery, it may not obstruct the flow of urine from the bladder through the wound ; this twofold indication may be effected by passing a gum elastic catheter, or a small silver canula, through a piece of sponge : the canula is to be directed into the bladder, and the sponge is to be passed deep into the wound ; the expansion of this substance will repress the hæmorrhage, particularly if aided by proper general treatment.

A wound of the artery of the bulb, in the adult, I should apprehend, might be attended with nearly as great danger as of the pudic artery itself ; and, therefore, in performing the lateral operation of lithotomy, every precaution should be taken to guard against this accident. This artery will be avoided in this operation, if we open the urethra behind the bulb and behind the triangular ligament, and not cut through this substance ; a very few fibres only of the base of this ligament require division, and the membranous part of the urethra should be opened just in front of the prostate gland. As the staff lies in the membranous part of the urethra, its lower or grooved edge will be found to be about one inch inferior to the arch of the pubis. If we introduce the knife into the urethra in front of

the triangular ligament, or at too high a point, that is, too near the arch of the pubis, we shall certainly divide the vessel I have just described.

5. *ARTERIA CORPORIS CAVERNOSI PENIS.* When the pudic artery has arrived at the ramus of the pubis, it pierces the triangular ligament, and runs between the bone and the crus penis; in this situation it divides into its two terminating branches, viz., the artery for the corpus cavernosum and that for the dorsum of the penis. The artery to supply the corpus cavernosum enters the crus penis obliquely, and runs through the centre of this organ, inclining towards the septum, and distributes its branches to either side; these branches open into cells, from which the corresponding veins take up the blood, as some suppose, by a power similar to the process of absorption. The arteries of opposite sides communicate with each other through the septum of the penis, they also send off many perforating branches which pass to the lining membrane of the urethra, and to the muscles and integuments of the penis.

6. *ARTERIA DORSALIS PENIS.* This is the last branch of the pudic artery, of which it appears the continuation; this artery ascends between the crus penis and the ramus of the pubis, and then runs in front of the pubic ligament, approaches the artery from the opposite side, with which it inosculates, or unites so as to form but a single vessel, and accompanied by the dorsal veins and nerves of the penis, it passes forwards and upwards between the laminæ of the suspensory ligament, and then continues its course along the dor-

sum of the penis, in the groove between its crura, as far as the corona glandis. In this course the dorsal artery is covered by the integuments and by the superficial fascia.

The dorsal arteries of the penis in many cases appear to enlarge near their termination; they anastomose very frequently with each other; they also send numerous branches to the integuments, some of which anastomose with branches from the femoral, obturator, and perinæal arteries. When these arteries have arrived near the glans penis, they each divide into several branches, which encircle the corona glandis, unite with each other, and send numerous branches to the prepuce, and into the glans; these last anastomose with the arteries of the corpus spongiosum urethræ.

In amputation of the penis, the arteries of the dorsum and of the corpora cavernosa may require to be secured by ligatures; they generally retract from the surface of the wound as soon as divided; the surgeon should, therefore, tie them. In some cases it will be necessary to tie four or five arteries, in other instances none of these branches will bleed to that degree as to require a ligature.

In my dissections of the arteries, I have occasionally observed that the pudic artery on one or both sides appeared unusually small; and on more accurate examination in such cases, I have found that the internal iliac had given off a distinct branch, which ran along the side of the bladder and prostrate gland, and passing beneath the arch of the pubis with the dorsal veins, became the dorsal artery of the penis: should

such a variety exist in one who was to become the subject for the lateral operation of lithotomy, I fear this artery must be wounded; and judging from its size and situation in those cases in which I have seen it take this course, I should apprehend very serious consequences from its division; it is not improbable, but that some of those alarming and fatal cases of hæmorrhage which have occurred even to the best operators, may have depended on this variety: this irregular branch I have seen to arise from the obturator artery.\*

I may observe, that I have noticed this variety very frequently in children under eight years of age, but as yet I have only met with three instances of it in the adult.

In the child the pudic artery is very small in proportion to its size in the adult; the corpus spongiosum urethræ, and the corpora cavernosa penis, being but little developed at this early age, their cells never being fully distended may account for the comparatively small size of the pudic artery, or of those branches which supply these organs; the muscles and integuments of the perinæum and penis, however, are as freely supplied with blood at that age as afterwards; this may probably account for the perinæal branches and the dorsal arteries of the penis being larger in proportion in the child, than the other branches of the pudic artery.

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\* A similar variety has been observed by Haller, Burns, and Barclay.

The pudic artery in the female has a similar origin and course to that in the male; there is also a considerable analogy in the distribution of its branches in the two sexes; in the female, however, it is rather smaller; in the pelvis it gives off several branches to the uterus and vagina, and in the perinæum it sends corresponding branches to those in the male subject, and ends in two branches, one to supply the crus, the other the dorsum of the clitoris.

Before the student proceeds to the dissection of any other artery, I should recommend him to re-examine the relative anatomy of the branches of the internal iliac artery; if he have not yet opened the pelvis, he may now make a section of this cavity by cutting through one ilio-sacral articulation, and with a saw divide the pubis of the same side between the symphysis and the thyroid foramen; he will thus obtain a more satisfactory view of the branches of the iliac artery in the pelvis, and he can then also better comprehend the course of the pudic artery, and the relative anatomy of the parts concerned in lithotomy.



## ARTERIÆ ILIACÆ EXTERNÆ.

EACH of the external iliac arteries in size and in direction appears as the continuation of the common iliac, and in the adult subject is considerably larger than the internal iliac. The external iliac is somewhat larger than the subclavian artery, and as the latter, which is destined to supply the superior extremity, continues undivided as far as the bend of the elbow, and receives different names according to the regions through which it passes; so the great trunk from which the inferior extremity derives its principal supply of blood, (successively denominated from the regions through which it extends, iliac, femoral, and popliteal), runs in an undivided course as far as the knee-joint, where from its first division arise the anterior and posterior tibial arteries. These arteries derive their names from their running nearly parallel to the tibia, one on its anterior, the other on its posterior surface, and they terminate in a free inosculation with each other in the foot.

The student will find it useful to attend to these divisions, and to study the relative anatomy of the artery of the lower extremity in each of these situations.

That portion of the artery which extends from the division of each common iliac, as far as the inferior border of Poupart's ligament, is generally named the external or anterior iliac artery; from this ligament the continuation of the same vessel receives the name

of femoral artery, which name it retains throughout the two superior thirds of the thigh, or until it has arrived at the opening in the tendons of the triceps : and from this to a short distance below the bend of the knee-joint, or to the lower margin of the popliteus muscle, it assumes the name of popliteal artery.

The external iliac arteries of opposite sides agree so accurately with each other in their course and termination, also in their relations and in the number of their branches, that one description will serve for both.

From the division of the common iliac arteries, each external iliac separates from that of the opposite side, and passes downwards and outwards, as far as Poupart's ligament. A line drawn from the umbilicus to a point about half an inch to the pubic side of the centre of this ligament, on either side, will represent the course of these arteries.

But little dissection is required to expose the external iliac artery ; the abdominal muscles being laid down towards the thigh, and the peritoneum torn from its loose attachments to the iliac fossa, the whole course of this artery is brought into view.

The external iliac artery descends along the inner side of the psoas muscle, to which it is connected by a thin membrane, which is derived from the iliac fascia external to this vessel, and which is then reflected over the iliac artery and vein, and descends into the pelvis. This membrane is so thin that these vessels are distinctly seen through it; it is, however, suffi-

ciently strong to prevent the artery being displaced or separated from the vein.

In the upper part of its course, the external iliac artery has only some loose cellular membrane behind it, as it descends it becomes more closely connected to the psoas muscle, and has the iliac fascia posterior to it; and when it has arrived near Poupart's ligament, it rests on the psoas, which is here supported by the pubis; in this situation the external iliac artery may be compressed during life. Its accompanying vein lies to its internal side, and at first rather posterior to it, but near Poupart's ligament it is on the same plane as the artery, and rests on the pubis, and upon a few fibres of the psoas and pectinæus muscles. The anterior crural nerve descends along the external or iliac side of the artery, separated from it by the psoas; it also lies on a plane posterior to the artery, being covered by the iliac fascia, and imbedded between the psoas and iliac muscles. Two or three small branches from this nerve, and from the lumbar plexus, are connected to the artery, and descend along its external side; these branches are distributed to the spermatic cord and to the integuments in the groin; small filaments from these nerves are sometimes seen passing across the artery and vein, and running towards the crural ring. A great number of lymphatic vessels accompany this artery; they principally ascend from the thigh on the pubal side of this vessel; if, however, they have been minutely injected with quicksilver, many will be found encircling the external iliac artery and vein,

The external iliac artery in this course is covered by the peritonéum, which, however, is very loosely connected to it.

When the external iliac artery is fully distended by injection, it appears to be convex forwards inferiorly, and concave forwards superiorly; when empty it is nearly straight; in the old subject it is sometimes a little tortuous, and appears somewhat depressed into the cavity of the pelvis.

The external iliac artery in the upper part of its course gives small branches only to the psoas and iliac muscles, and to the surrounding cellular membrane and lymphatic glands; none of these branches are sufficiently large or regular to receive distinct names; but near Poupart's ligament, two branches of considerable size almost always take their origin from the external iliac, namely, the epigastric and circumflexa ilii.

## I.

### ARTERIA EPIGASTRICA.

THIS artery is one of considerable size, and very regular in its origin and course; it supplies the anterior part of the abdominal parietes, and inosculates with the internal mammary arteries.

To trace this artery, the student may either throw down the abdominal muscles towards the thigh, and detaching the peritoneum from these, the whole course of this vessel will be brought into view; or without

opening the abdomen, he may expose this artery by dividing the integuments, the inferior portion of the abdominal muscles, and the fascia transversalis, in the direction of the artery : that is, from the groin towards the umbilicus ; I should recommend the student to dissect this vessel according to each of these plans on the opposite sides of the subject.

The epigastric artery generally arises from the external iliac about a quarter or half an inch above Poupart's ligament ; but sometimes it arises immediately behind this line, and in some cases it proceeds from the femoral and even from the internal circumflex artery. When the epigastric artery arises higher than Poupart's ligament, it first descends to reach this, and then turns forwards and upwards, thus making an arch, which is convex inferiorly, into the concavity of which the peritoneum descends ; when it arises immediately behind or below Poupart's ligament, its course is then directly forwards and upwards. From Poupart's ligament the epigastric artery inclines a little inwards across the iliac vein, it then ascends obliquely towards the rectus muscle, and passes behind the superior angle of the abdominal ring. This artery is covered by the integuments, by the inferior portion of the oblique and transversalis muscles, also by the spermatic cord and fascia transversalis, and ultimately by the rectus muscle ; it at first lies on the peritoneum, and shortly after its origin it passes in front of the vas deferens, as this duct is passing towards the pelvis. When the artery arrives at the rectus muscle, it en-

ters the sheath of this muscle, which then separates it from the peritoneum.

As the epigastric artery lies behind the inguinal canal, it is about a quarter of an inch to the pubic side of the internal abdominal ring; in this situation the vas deferens may be observed almost to hook round this artery, for as that duct lies in the spermatic cord, and of course in the inguinal channel, it is anterior to the epigastric artery, but as it passes through the internal abdominal ring, it lies on its external or iliac side, separated from it by the spermatic artery; and lastly, as the vas deferens is inclining inwards and backwards towards the pelvis, it lies behind this artery. As the epigastric artery ascends from the inguinal canal towards the rectus muscle, it lies internal and nearly parallel to the linea semilunaris; it is accompanied by a large vein, which lies to its pubic side; sometimes there are two epigastric veins, one on either side of the artery.

The epigastric artery gives off several branches; first, as it passes behind the spermatic cord it sends two or three branches to the cremaster muscle; these descend in the cord, and communicate with the proper spermatic arteries; these branches are sometimes very much enlarged in disease of the testicle. Secondly, as the epigastric artery ascends towards the rectus, it gives off several branches, particularly from its external side; these are distributed to the abdominal muscles and to the peritoneum; several branches also pass through openings in the tendon of the external oblique muscle, these supply the integuments, and inosculate



with the external epigastric from the femoral artery. Thirdly, when the epigastric artery has entered the sheath of the rectus, it divides into numerous branches, which ascend between the fibres of this muscle, principally near its posterior surface; at the umbilicus these branches meet corresponding branches from the opposite side, and descending branches from the internal mammary, and intercostal arteries.

In the marsupial animals, as the Kangaroo, the epigastric arteries are larger, to supply the pouch and the mammary glands.

The student should particularly study the relations of the epigastric artery to the parts concerned in hernia. Inguinal hernia is either oblique or direct; the former commences at the internal abdominal ring, and takes the course of the spermatic cord; if a stricture exist at the neck of the sac, that is, at the internal abdominal ring, the edge of the bistoury should be directed upwards and outwards, so as to avoid the epigastric artery. Direct inguinal hernia protrudes from the abdomen directly through the external abdominal ring; if the stricture exist in the neck of the sac in this form of hernia, it should be divided by turning the edge of the bistoury upwards and inwards. If hernia be of recent occurrence, no matter whether it be oblique or direct, the rule of cutting directly upwards in all cases may be adhered to; but should the disease have been of long standing, the sac may be found to have so altered the course of the epigastric artery, that this vessel will, in some cases, be found to encircle three-fourths of the neck of the tumour: and

if the edge of the knife were turned directly upwards, the artery must be divided. If a stricture exist below the neck of the sac in any part of the spermatic channel, it may be divided in any direction, as the epigastric artery is behind the fascia transversalis.

In femoral hernia, the epigastric artery runs very near the anterior part of the neck of the sac, and might be wounded in the operation, if the edge of the knife were directed forwards and outwards.

Should this artery be accidentally wounded in the operation for strangulated hernia it must be more fully exposed by an incision made in its direction, and then secured by ligature.

Although the epigastric artery during health ascends internal, or nearer to the linea alba than to the linea semilunaris, and will not be endangered in the operation of paracentesis of the abdomen, yet in ascites the recti muscles become so much expanded, that in performing this operation we should recollect, that this artery and the linea semilunaris lie more externally, or nearer to the ilium, than natural.

## II.

### ARTERIA CIRCUMFLEXA ILII.

THIS artery arises from the anterior and external part of the external iliac, opposite to, or a little lower down than the origin of the epigastric; its course is upwards and outwards towards the spine of the ilium, where it divides into numerous branches to supply the iliac and abdominal muscles.

The circumflex ilii artery may be exposed by throwing down the abdominal muscles, and removing some cellular membrane on the inside of Poupart's ligament; a white tendinous line may then be seen extending from the iliac artery to the spine of the ilium; this line is about a quarter of an inch within Poupart's ligament, and marks the attachment of the iliac and transverse fasciæ to it and to each other; if this line be divided, this artery will be exposed.

The circumflex ilii artery from its origin runs upwards and outwards, towards the anterior superior spinous process of the ilium, and passes across the psoas and iliac muscles, and the anterior crural nerve. In this course it gives off some small arteries to the inguinal glands, and to the muscles on either side; at the spine of the ilium it sends several branches upwards to the abdominal muscles; some of these ramify between the transversalis and internal oblique, and some between the latter and the external oblique muscle. The continuation of the circumflex ilii artery then passes backwards along the internal surface of the crest of the ilium, and meets the ilio-lumbar artery from the internal iliac. In this course the circumflex artery sends off numerous branches, some of which descend to supply the iliac muscle, others ascend to the abdominal muscles; small branches also turn over the crest of the ilium to the glutæi muscles, and anastomose with the gluteal arteries. The anastomosis between this artery and the ileo-lumbar, forms a very free communication, one which must be of essential service in maintaining the circulation in the

lower extremity, in case the external iliac artery has been obliterated.

The external iliac artery may require to be tied in cases of wound or aneurism of the femoral artery, or in case of secondary hæmorrhage after this artery has been tied for popliteal aneurism.

The external iliac artery has been very frequently the subject of operation, and has been attended with more success than has followed similar operations on other arteries. The communications between the branches of the internal iliac and femoral arteries are so free and numerous, that little doubt can be entertained as to the probability of their carrying a sufficient supply of blood for the nourishment of the extremity, in case the main artery becomes obstructed. Observations in the living subject of cases of inguinal aneurism, in which the disease had cured itself by the sloughing of the sac, and consequent obliteration of the artery, has proved that the anastomosing branches are capable of thus maintaining the circulation. Experiment in the dead subject also confirms this opinion, for if the external iliac artery be tied, and fine injection forced from the internal iliac or from the aorta, the limb on that side will be injected equally with the other.

The principal channels through which the communication is maintained, when the external iliac artery has been obliterated, are the ileo-lumbar and circumflexa ilii arteries anteriorly; the obturator and internal circumflex arteries internally; the gluteal and external circumflex arteries externally; and the gluteal,

sciatic, pudic, circumflex, and perforating arteries posteriorly.

Mr. Abernethy first performed the operation of tying the external iliac artery; Mr. Hodgson gives an account of twenty-two instances in which this operation has been performed, in fifteen cases of which there was a complete recovery; in this city this artery has been frequently tied with success. Mr. Hodgson very properly remarks, that the number of cases in which this operation has succeeded, so much exceeds the number of those in which it has terminated unfavourably, that it may be regarded as decidedly established, that the external iliac artery may be tied with as much safety as any artery to which a ligature has been applied for the cure of aneurism. Indeed the success which has followed this operation, has so far exceeded that which has attended the operation of tying the femoral artery for the cure of popliteal or femoral aneurism, that some surgeons have suggested the propriety of performing the iliac operation in the first instance for the cure of those diseases.

Different plans have been recommended for exposing the external iliac artery. The following is the method which Mr. Abernethy pursued, in order to pass a ligature around this vessel: the patient being placed upon a table in a horizontal position, an incision three or four inches in length is to be made through the integuments of the abdomen, in the direction of the external iliac artery. This incision will be situated about an inch and a half from the anterior superior spine of the ilium, towards the linea alba, and nearly

an inch on the outside of the external abdominal ring; the lower extremity will terminate about half an inch above Poupart's ligament. The sides of this incision being separated, the aponeurosis of the external oblique muscle will be exposed, and is to be divided throughout the extent of the external wound: the finger is then to be introduced underneath the inferior margin of the internal oblique and transverse muscles, so as to protect the peritoneum, whilst the operator divides these muscles with a knife or a probe-pointed bistoury. The finger is then to be passed beneath the peritoneum, and this membrane to be pushed upwards and inwards, by the side of the psoas muscle; the pulsation of the artery may be then distinctly felt about two inches above Poupart's ligament. The external iliac vein is situated on the inside of the artery; the psoas muscle lies between the artery and the anterior crural nerve. The artery and vein are connected together by dense cellular membrane, which is to be separated with the nail, or cautiously divided with a knife, so as to enable the operator to introduce the point of the aneurism needle between the artery and vein, and bring it out on the opposite side of the former; the ligature, which is thus conveyed round the artery, being secured, the wound is to be closed with strips of adhesive plaster. When the patient is placed in bed, the thigh should be bent upon the pelvis, so as to place the artery in a relaxed condition.\*

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\* See Hodgson on Diseases of the Arteries, p. 419, and Abernethy's Surgical Works, vol. i.



The advantage of this mode of performing this operation is, that the external iliac artery may be tied very high up in the abdomen; it is, therefore, peculiarly applicable to cases of inguinal aneurism, in which the tumour has extended as high as Poupart's ligament, and where we are desirous to tie the artery at some distance from the disease.

Sir A. Cooper performs this operation in the following manner: he makes a semilunar incision, the convexity of which looks downwards and outwards through the integuments in the direction of the fibres of the aponeurosis of the external oblique muscle; one extremity of this incision will be situated near the spine of the ilium; the other will terminate a little above the inner margin of the abdominal ring. The aponeurosis of the external oblique muscle will be then exposed, and is to be divided throughout the extent and in the direction of the external wound; the flap, which is thus formed, being raised, the spermatic cord will be seen passing under the margin of the internal oblique and transverse muscles. The opening in the fascia which lines the transverse muscle, through which the spermatic cord passes, is situated in the mid space between the anterior superior spine of the ilium, and the symphysis pubis; the epigastric artery runs precisely along the inner margin of this opening, beneath which the external iliac artery is situated. If the finger, therefore, be passed under the spermatic cord through this opening in the fascia which lines the transverse muscle, it will come into immediate contact with the artery, which lies on the outside of the ex-

ternal iliac vein. The artery and vein are connected together by dense cellular membrane, which must be separated, to enable the operator to pass a ligature, by means of an aneurism needle, round the former.

According to this plan, this operation may be performed with very little disturbance to the peritoneum, and but little injury to the abdominal parietes; the artery lies very superficial, immediately above Poupart's ligament, and, therefore, the operation, according to Sir A. Cooper's plan, is more easily and expeditiously performed, particularly in a robust or corpulent person, than according to the mode adopted by Mr. Abernethy, and may therefore, in general, be preferred.

## ARTERIA FEMORALIS.

WHEN the external iliac artery has passed below Poupart's ligament, the name of femoral is given to this great vessel; and this name it retains until it arrives at the opening in the tendon of the triceps, through which it passes into the popliteal space, where it receives the name of popliteal artery.

If the distance between Poupart's ligament and the knee-joint be divided into three equal portions, the femoral artery will be found to extend through the two superior, and the popliteal through the inferior third.

The course and connexions of the femoral artery the student may now proceed to examine; at first, therefore, the dissection may be confined to the superior and middle thirds of the thigh; place the limb in the following position: as the subject lies on the back, bend the knee and rotate the limb outwards as much as possible, so that the inner side of the thigh may look forwards; then raise the integuments from the anterior part of the limb, from Poupart's ligament, to within three or four inches of the knee; a large cutaneous vein is then exposed, the internal saphena; this vein ascends from the inner side of the leg and knee, along the internal and anterior part of the thigh towards the groin; in this course it lies on the fascia lata, which membrane it perforates about two inches below Poupart's ligament, and then joins the femoral

vein. Two or three large lymphatic glands are generally found in this situation; they lie parallel to the vein, and in some cases one of them lies behind this vessel. The opening in the fascia lata, through which the saphena vein passes, is of a semilunar figure, the concavity looking upwards; it is best seen by dividing the vein on the thigh, and raising it up towards the groin; although the edge of this opening appears sharp, yet from it the fascia is reflected backwards and downwards, and is lost on the sheath of the femoral vessels.

As the saphena vein ascends on the inside of the thigh, it lies on a plane internal to the femoral artery, and may, therefore, be avoided in the living subject in the operation of tying this vessel. In the groin the saphena vein frequently receives one or two considerable veins from the anterior and external part of the thigh, as well as several branches from the conglobate glands in this region. In the space between the termination of this vein and Poupart's ligament, several lymphatic glands are situated; these are attached to the superficial fascia, some lying beneath it, others between its laminae; some of these glands lie on, and are parallel to Poupart's ligament, others lie over the femoral vessels, and are connected to these by several small arteries and veins.

If the student now proceed to remove the superficial fascia and the lymphatic glands, he may remark the intimate connexion between this membrane and the fascia lata, a little below Poupart's ligament; hence it is, that these glands are bound down by the superficial

fascia, and hence is the principal source of that difficulty which is occasionally experienced in distinguishing between diseases of these glands, and of the subjacent vessels. Ulceration in the inguinal glands may extend to the coats of the femoral artery, and so give rise to hæmorrhage, which may be suddenly fatal, or may require the operation of tying the iliac artery.

The student may next observe the connexions of the fascia lata in this situation; between the termination of the saphena vein and Poupart's ligament this fascia may be divided into three portions, an internal, middle, and external; the internal or pubic portion covers the pectineus and adductor muscles, and is attached superiorly to the linea innominata or ileo-pectinea, anterior to the attachment of Gimbernaut's ligament; internally it extends over the gracilis and the adductor muscles, and is inserted into the ramus of the ischium and pubis; externally it passes behind the sheath of the femoral vessels, and is attached to the fascia iliaca, and to the capsular ligament of the hip-joint. The middle portion of the fascia lata is very thin, and has been termed the cribriform portion; it extends from the saphena vein to Poupart's ligament, is connected on either side to the pubic and iliac portions of the fascia lata, and posteriorly to the fore part of the sheath of the femoral vessels, which in this situation is derived from the fascia transversalis. The cribriform fascia covers the femoral vessels, and is perforated by the arteries and veins of the inguinal glands, and by the lymphatic vessels passing up to the

*Summe of Fascia lata*

iliac glands; this portion of the fascia lata is more closely connected than any other to the superficial fascia. The external or iliac portion of the fascia lata is very dense and strong, it is continued from the external surface of the thigh, and is intimately attached superiorly to the spine of the ilium, and to Poupart's ligament; and uniting with the cribriform fascia, is continued in front of the femoral vessels, along with the inferior fibres of Poupart's ligament, and is inserted along with these into the linea innominata, thus assisting to form the external part or the base of Gimbernaut's ligament. If the cribriform fascia be removed along with the superficial fascia, then the iliac portion of the fascia lata will present the appearance of a crescentic or falciform process, extending across the femoral vessels, the concavity of which process will look downwards and inwards.

The fascia lata covers the different muscles, nerves, and vessels, in the inguinal region,\* and must, therefore, be divided, to expose the several parts in this situation. This region may be considered to occupy the upper third of the fore part of the thigh, and to be of a triangular figure, the base, superiorly, formed by Poupart's ligament, and the apex, inferiorly, by the meeting of the sartorius and adductor muscles; the external or iliac side, which is on a plane anterior to

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\* The term inguinal region is differently applied by different authors, by some to the spermatic channel and adjacent parts, and by others to the upper part of the front of the thigh; it is in the latter sense the term is used above.



the pubal, is formed by the sartorius, iliac, and rectus muscles, and the internal or pubal side by the pectinæus and adductor longus muscles.

Through this region the femoral artery passes obliquely downwards, backwards, and inwards, somewhat in a spiral manner in reference to the thigh bone, for, superiorly this vessel lies anterior to the femur, in the middle it lies internal to it, and in the popliteal space the artery is behind the bone.

A line drawn from the centre of Poupart's ligament to the inner edge of the patella, will be nearly parallel to the course of the femoral artery.

The student should first examine the connexions of the femoral artery in the upper, and afterwards in the middle third of the thigh: to expose it in the first division of its course, it is only necessary to divide the fascia lata from Poupart's ligament to the meeting of the sartorius and adductor muscles, when by removing a little cellular membrane, the sheath of the vessel will be brought into view.

In the superior third of the thigh the femoral artery is covered only by the integuments, superficial fascia, some lymphatic glands, and by the fascia lata; and inferiorly the sartorius muscle overlaps it a little. In this division of its course the femoral artery is first placed on the psoas magnus, which muscle is here supported by the acetabulum, by the head of the femur, and by the capsular ligament; below this the femoral artery has no support immediately behind it, but lies on a quantity of cellular membrane, and on several branches of veins and arteries, which separate

it from the insertion of the pectinæus and adductor brevis muscles, over which muscles the artery passes, but at a considerable distance from them, particularly if the limb be turned inwards; if, however, the thigh be rotated outwards, the lesser trochanter and the muscles which are inserted below it are then brought forward, so as to lie nearer to the artery. The femoral artery next lies on the tendon of the adductor longus muscle, and then pursues its course through the middle third of the thigh, where we shall examine it afterwards.

In the superior third of the thigh then, the femoral artery is very superficial; during life it can be felt pulsating through the entire of this part of its course, but particularly strong immediately below Poupart's ligament; it here, in the extended state of the thigh, appears pushed forwards by the acetabulum and head of the femur, from both which, however, it is separated by the fleshy fibres of the psoas.

Behind the psoas muscle in this situation, is a large bursa mucosa, which lies on the pubis and on the capsular ligament, it sometimes communicates with the joint; if this bursa be distended, as it sometimes is after violent exercise, or in inflammation of the joint, it will form a tumour in the groin, behind and around the artery; this tumour may in some respects resemble aneurism, from which, however, it can be discriminated by making a careful examination, the thigh being flexed, so as to relax the fibres of the psoas and iliac muscles.

The femoral vein lies very close to the artery in this

part of its course; immediately below Poupart's ligament it lies to its pubic side, and rests upon a few fibres of the psoas, and upon the pubis between this muscle and the pectinæus; as it descends it gradually inclines behind the artery, so that at the tendon of the adductor longus the vein is covered by the artery, and is very intimately attached to it.

The anterior crural nerve lies about half an inch to the iliac side of the femoral artery, immediately below Poupart's ligament, and is deeply imbedded between the iliac and psoas muscles; but three or four of its branches soon approach the artery, and descend along the external side of its sheath; small branches of these nerves also sometimes pass in front of its sheath to the adductor muscles, and one long branch (*nervus saphenus*) enters the sheath opposite the upper edge of the tendon of the adductor longus, and may be afterwards traced down the middle third of the thigh, along the outer and anterior part of the artery.

The student may now proceed to examine the femoral artery in the middle third of the thigh; to expose it in this part of its course the sartorius must be drawn to one side after the integuments and fascia lata have been raised; behind the sartorius is a very strong fascia, composed of tendinous fibres, which proceed in a transverse direction from the vastus internus to the tendons of the adductor magnus and longus muscles; this aponeurosis commences superiorly where the sartorius is first passing in front of the artery, and is here very thin, but about the middle of the thigh it is very

dense; it terminates at the upper part of the inferior third, in a well defined edge, beneath which passes the saphena nerve and a small artery: if this fascia be divided, the femoral artery and vein will be exposed.

As these vessels descend along the middle third of the thigh, they lie in a sort of tendinous canal; this canal is of a triangular figure, and is bounded anteriorly by the fascia just now described; externally by the vastus internus; internally by the tendon of the adductor longus and magnus; and posteriorly by the conjoined tendons of the vastus internus and adductor muscles; which tendons are united to each other for at least one inch before they arrive at the linea aspera, into which they are inserted. In the middle third of the thigh the femoral artery lies to the internal side of the femur, but is separated from the bone by the vastus internus muscle: during this part of its course the femoral vein lies posterior to the artery, and is very closely connected to it; the saphena nerve is here enclosed in this sheath of the artery, and lies on the anterior and external part of this vessel.

At the lower part of the middle third of the thigh the femoral artery and vein pass into the popliteal space, through an opening between the tendons of the triceps and vastus internus muscles; this opening is of an oval figure, its edges are tendinous, so that the contraction of the surrounding muscles cannot interrupt the circulation in these vessels; this opening is bounded superiorly by the tendons of the adductor longus and magnus; externally, by the vastus internus; internally, by the tendon of the adductor mag-

nus; and inferiorly, by the conjoined tendons of the last named muscle, and of the vastus internus. The saphena nerve does not accompany the femoral artery through this opening, but continues its course down the inside of the thigh, covered by the sartorius muscle; at the knee this nerve lies between the tendons of the gracilis and sartorius, it then becomes a cutaneous nerve, and accompanies the saphena vein along the inner side of the leg as far as the internal ankle.

The student may postpone the examination of the popliteal artery until he has dissected the branches of the femoral, as well as considered the practical inferences which may be deduced from an attentive consideration of the relative anatomy of this vessel. The femoral artery in its course through the superior and middle thirds of the thigh, gives off several branches to supply the integuments and muscles of this region.

In the superior third of the thigh it sends off four principal branches, three of which supply the lymphatic glands in the groin, and the integuments of the abdomen; these three branches are named the *arteria epigastrica superficialis*, *arteriæ pudendæ externæ*, and *arteria circumflexa ilii superficialis*; the fourth is a very large branch, and is named the *arteria profunda femoris*; this artery arises about two inches below Poupart's ligament, and supplies the principal muscles of the thigh, and may be considered the proper artery of this region, while the continued femoral or crural artery is destined to the leg. Besides these four branches, the femoral artery, in the superior third



of the thigh, sends off several small and unnamed branches to the sartorius, iliacus, pectinæus, and adductor muscles, and to the surrounding cellular membrane. In the middle third of the thigh the femoral artery gives off several branches to the muscles which surround it; and as it is about to become the popliteal artery, it gives off a long branch which descends to the inner side of the knee-joint, named *arteria anastomotica magna*; these several branches the student may now proceed to expose.

## I.

### ARTERIA EPIGASTRICA SUPERFICIALIS.

THIS artery arises from the fore-part of the femoral artery, about half an inch below Poupart's ligament; in size it is inferior to the internal epigastric, nearly parallel to which it runs. The superficial epigastric artery pierces the fascia lata, and turns over Poupart's ligament, and ascending on the abdominal muscles, is only covered by the integuments; it runs towards the umbilicus, where it ends in an anastomosis with small branches from the internal epigastric, and from the mammary arteries. The superficial epigastric artery, immediately after its origin, gives off small branches to either side, to the inguinal glands; and as it ascends on the abdomen, its branches are distributed to either side, to the integuments and superficial fascia; all these branches are accompanied by corresponding veins. The superficial epigastric artery, like other superficial arteries, varies much in size; in some they



are so small that they can be traced for a short distance only, while in others they are large and tortuous, as is often the case in ascites. The superficial epigastric artery must be divided in the operation for the relief of strangulated hernia.

## II.

### ARTERIÆ PUDICÆ SUPERFICIALES VEL EXTERNÆ,

ARE generally two in number, a superior and inferior, they are smaller than the epigastric artery ; they arise from the femoral artery, close to the last described branch, and frequently from a short trunk common to both. The superior superficial pudic artery passes upwards and inwards, towards the pubis, and then divides into several long and tortuous branches, some of which pass above, others below the spine of the pubis ; they are all distributed to the external parts of generation, and inosculate with the perinæal artery, and with cutaneous branches from the internal pudic.

The inferior of these pudic branches is not always present ; it sometimes arises from the superior branch, sometimes from the trunk of the femoral, and sometimes from the internal circumflex ; it lies deeper than the superior, its course is in a transverse direction, towards the perinæum, it passes across the pectinæus muscle, and is covered by the fascia lata ; the branches of this artery are distributed to the muscles and integuments in the perinæum. The superior of these

pudic branches also is liable to be divided in the operation for strangulated femoral and inguinal hernia.

### III.

#### ARTERIA CIRCUMFLEXA ILII SUPERFICIALIS,

Is smaller than either of the two last branches, close to which it arises ; it is covered by the integuments, and runs parallel to Poupart's ligament, as far as the spine of the ilium ; it then divides into several branches, which pass in different directions, and communicate with cutaneous branches from the deep circumflex ilii artery, also with superficial twigs from the gluteal and from the external circumflex artery, a branch of the profunda femoris.

### IV.

#### ARTERIA PROFUNDA FEMORIS.

THIS is an artery of considerable magnitude and importance ; it is the principal vessel for supplying the great mass of muscles on the front, as well as those on the internal and posterior part of the thigh.

The arteria profunda arises from the external and rather from the posterior part of the femoral artery ; in general, about two inches below Poupart's ligament, sometimes an inch or two lower down, and sometimes much nearer to this ligament ; the profunda occasionally appears as large as the continuation of the

femoral, so that this trunk appears to divide into two arteries of nearly equal size.

The *arteria profunda* first bends outwards, towards the *sartorius* muscle, so as to appear on the iliac side of the femoral artery; it then turns backwards and inwards, pierces the deep layer of *fascia lata*, and descends on the inside of the femur, parallel to the femoral artery, but at a considerable distance behind it, and separated from it by the femoral and profunda veins, by a quantity of cellular membrane which contains a number of small veins and arteries, and lastly, by the tendon of the *adductor longus*.

In this course the profunda artery gives off numerous branches to the muscles, and terminates in a muscular branch a little below the middle of the thigh.

To expose this artery and its branches is a troublesome dissection; it will be facilitated by dividing the femoral artery and vein below the origin of the profunda, and removing them from their situation. In the upper part of the thigh there is a considerable quantity of cellular membrane and numerous veins behind the sheath of these vessels, which must be removed; the different muscles at the inner side of the thigh should be cleanly dissected, and partly separated from each other; the muscles on the posterior part of the thigh also should be exposed, and partly detached from their connexions.

The profunda artery at first lies on the *psoas* and *iliac* muscles, it then passes over the *cruræus* and *vastus internus*, and descends in front of the insertion of

the pectinæus and adductor brevis, and behind the tendon of the adductor longus muscles, and terminates in a small branch, which passes through the adductor magnus, to the back part of the thigh, is distributed to the hamstring muscles, and ends in numerous anastomoses with the perforating branches, and with small arteries from the popliteal.

The profunda artery, in the first part of its course, that is, while on the iliac side of the femoral artery, is only covered by the fascia and integuments of the thigh; afterwards, as it descends, it is concealed by the femoral artery and vein, to which it runs nearly parallel, but at a much greater depth in the thigh, and lastly, it is covered by the tendon of the adductor longus.

The branches of the profunda artery are numerous and complicated; to make a careful dissection of them requires much time and care. In addition to several small and nameless branches which the profunda artery gives off, there are five or six of considerable size, which have received particular names. The two first are the *external and internal circumflex arteries*; these arteries supply the muscles around the hip-joint, and anastomose with each other, and with several other arteries around this articulation; the three or four remaining branches of the profunda are named the *perforating arteries*; these branches pass through the tendons of the adductors, to the muscles situated on the back part of the thigh.

## I.

## ARTERIA CIRCUMFLEXA EXTERNA,

ARISES from the profunda while this vessel is on the iliac side or behind the femoral artery ; it is generally, but not always, its first branch.

The external circumflex artery is a large but short trunk, it soon divides into a great number of branches to supply the muscles on the outer and fore-part of the thigh. This artery runs in a direction outwards towards the sartorius, and passes through the divisions of the anterior crural nerve ; it lies in a quantity of loose cellular and adipose substance, between the tensor vaginæ and psoas and iliac muscles, in front of the latter, and behind the sartorius and rectus ; its branches may be divided into three sets, ascending, descending, and circular or circumflex. The first, or ascending set, consists of three or four small branches, which pass under the sartorius and tensor vaginæ femoris muscles, and then ascend between this muscle and the glutæus medius and minimus, towards the spine of the ilium ; these branches assist in supplying the several muscles in their vicinity, and anastomose with the gluteal arteries, and with small branches of the internal circumflex ilii.

The circumflex branches are seldom more than two or three in number ; they pass deeper than those last described, and are covered by the sartorius, tensor, and rectus femoris muscles ; these branches pass in

front of the *cruræus*, and penetrate the *vastus externus* muscle below the great trochanter; some perforate the tendinous expansion of the *glutæus maximus*, and arrive at the back part of the thigh, where they anastomose with the internal circumflex, gluteal, and sciatic arteries from above, and with branches from the perforating arteries from below.

The descending branches of the external circumflex artery are five or six in number, they are very long and of considerable size; they descend along the anterior part of the thigh, accompanied by branches of the anterior crural nerve; some of these arteries run in the substance of the *rectus*, some between the *cruræus* and *vastus internus*, and others, the principal, between the *cruræus* and *vastus externus*. These branches supply the extensor muscles, and may be traced near to the knee-joint, where they terminate in free inosculations with the external and internal articular arteries, and with small branches from the femoral artery in the *vastus internus* muscle.

These descending branches are sometimes greatly enlarged in long continued disease of the knee-joint: and in such cases, when amputation of the thigh is to be performed, it will often be necessary to tie several arteries.

The chain of anastomoses between the gluteal, external circumflex and articular arteries around the hip and knee-joints, must be of considerable importance in maintaining the circulation in the lower extremity, in case the femoral or external iliac artery has been obliterated.



The external circumflex artery not unfrequently arises from the femoral, and sometimes instead of proceeding from it or from the profunda, as a distinct trunk, three or four branches arise separately, and take the course of the divisions of the external circumflex artery now described.

## II.

### ARTERIA CIRCUMFLEXA INTERNA.

THIS artery in general arises from the profunda, immediately after the external circumflex : its course is backwards and inwards ; it supplies the articulation of the hip and the muscles at its internal and posterior part.

The dissection of this artery is rather difficult ; the pectinæus, gracilis, adductor brevis and longus muscles must be divided ; in doing so care should be taken to avoid injuring the branches which these muscles receive.

The internal circumflex artery passes backwards nearly parallel to the tendon of the psoas, between it and that of the obturator internus, and between the head and lesser trochanter of the femur. It is surrounded by a quantity of loose cellular membrane, and is situated in a sort of cavity of a triangular figure, bounded externally by the capsular ligament, by the neck of the femur, and by the psoas and iliac muscles and tendon ; superiorly, by the obturator externus, and internally by the adductor muscles ; this space is

covered anteriorly by the pectinæus; and partly closed posteriorly by the adductor magnus and quadratus femoris, between which muscles there is a narrow fissure, through which pass the terminating branches of this artery.

In this course the internal circumflex artery gives off several branches to supply the pectinæus, adductor brevis, and longus muscles; when the pectinæus is divided, a very free inosculation between these branches and the obturator artery is exposed. Several small branches from the internal circumflex artery pass through the upper extremity of the adductor brevis and gracilis muscles, and are distributed to the integuments of the perinæum. In addition to these branches, the internal circumflex artery gives off from its external side a small branch (the *articular artery*,) which passes beneath the ligament, covering the notch at the lower and internal part of the acetabulum; this artery then ramifies in the soft adipose substance in this cavity, and on the ligamentum teres and the synovial membrane of the joint; this articular branch sometimes arises from the obturator artery, and in some subjects, the joint receives branches from both these arteries.

The termination of the internal circumflex artery may be seen on the back part of the thigh; raise the lower edge of the glutæus maximus, draw to one side the sciatic nerve, and then separate the inferior margin of the quadratus femoris from the superior border of the adductor magnus, the internal and circumflex artery will be then seen dividing into two branches, a

superior and inferior: the former ascends and passes outwards along the obturator externus tendon, to the digital cavity behind the great trochanter, where it anastomoses with the gluteal and with the external circumflex arteries. The inferior branch is the larger, it passes backwards, between the quadratus and adductor magnus, and divides into several branches which are distributed to the glutæus maximus, semi-tendinous, semi-membranosus and adductor magnus muscles, also to the sciatic nerve; these branches communicate with the superior perforating, and with the gluteal and sciatic arteries.

These inosculations between the internal circumflex artery and the branches of the internal iliac, are of considerable importance in establishing collateral circulation, in case the external iliac or the femoral artery has been obliterated.

The internal circumflex artery is a very regular branch, as to its course and termination; its origin, however, varies; it very frequently proceeds from the femoral artery, prior to the origin of the profunda, in which case it arises before the external circumflex artery; when it is derived from the profunda, it is generally, but not always, subsequent to the origin of the external circumflex artery.

As the profunda artery pursues its course along the internal side of the thigh, after giving origin to the circumflex arteries, it continues to send off several branches: from its external side numerous small arteries arise, which pass to the vastus internus and

cruræus; from its posterior part proceed three or four large branches, named the perforating arteries.

3. *ARTERIA PERFORANS PRIMA*, arises from the profunda, opposite the lesser trochanter; it passes backwards between the tendons of the pectinæus and adductor brevis, (it sometimes runs through an opening in the tendon of the adductor brevis,) it then perforates the adductor magnus close to the linea aspera, and divides into branches. In this course the first perforating artery supplies the pectinæus, adductor brevis and magnus muscles; its terminating branches are distributed to the biceps, vastus externus, and glutæus maximus, and communicate with branches from the glutæal, sciatic and circumflex arteries from above, and with the other perforating arteries from below. This perforating artery is sometimes a branch from the internal circumflex artery; its course is nearly parallel to that vessel, and is separated from it by the tendon of the pectinæus muscle; the first perforating artery passing below that tendon, while the circumflex artery runs superior to it.

4. *ARTERIA PERFORANS SECUNDA*, is in general a much larger branch than that last described. This artery passes backwards, through a foramen in the tendon of the adductor brevis, it then perforates the adductor magnus, and arriving at the posterior part of the femur, divides into several branches; some of which ascend to the glutæus maximus and vastus externus; others descend, and supply the hamstring muscles and the sciatic nerve; a considerable branch

also may be sometimes seen to enter the femur by an oblique canal in the linea aspera. In this course the second perforating artery supplies the adductor muscles also; its branches on the posterior part of the thigh form a complete network of vessels between the different muscles in this region, and numerous branches from it terminate in free inosculations with different arteries, namely, superiorly with the sciatic, glutæal, internal and external circumflex and superior perforating arteries; and inferiorly, by means of very large branches which descend with the inferior branches of the profunda, and with branches of the popliteal artery.

This second perforating artery does not always pass through the tendon of the adductor brevis, it sometimes runs inferior to it.

5. ARTERIA PERFORANS TERTIA, arises from the profunda, at the upper edge of the tendon of the adductor longus, and passing backwards, it perforates the adductor magnus, and is then distributed to the back part of the thigh in a manner similar to the other perforating arteries.

The profunda artery having given off these several branches becomes much diminished in size, and terminates in a small but long branch, which is by some considered as the fourth perforating artery; it passes behind the tendon of the adductor longus, parallel to the femoral artery, perforates the adductor magnus, and descends obliquely outwards along the posterior part of the thigh; it then divides like the other perforating arteries into several branches, which supply the

hamstring muscles, principally the short head of the biceps, and inosculate with branches of the popliteal from below, and with the perforating arteries from above.

The perforating branches of the profunda maintain a chain of free inosculations on the back part of the thigh from the pelvis to the knee, connecting the branches of the internal iliac artery with those of the femoral and popliteal; these inosculations are found very distinct and free in cases where the external iliac or femoral artery has been obliterated.

The student is not to be surprised if he find the foregoing description of these branches not exactly to accord with their course in every subject. The perforating arteries are very regular as to their existence and destination, but with respect to their origin, number, and relation to muscles, they are very uncertain, and no description can embrace the numerous varieties they present.

The student having concluded the dissection of the profunda, may next examine the other branches which the femoral artery sends off in its course down the thigh; these branches are distributed to the muscles on the inner and fore-part of the limb, and are so irregular in their origin and course, that they have received no distinct names, some are very small, others are of considerable size; the sartorius receives the principal share of these.

When the femoral artery is about to become the popliteal, it gives off the next branch, which is con-



sidered of sufficient importance to receive the following name :—

6. *ARTERIA ANASTOMOTICA MAGNA*, arises from the femoral artery, as this trunk is about to enter the opening in the tendon of the triceps ; it descends to the inner side of the knee-joint. This artery immediately after its origin passes from beneath the edge of that fascia which was before described as covering the femoral artery in the middle third of the thigh : it then descends towards the inner condyle, inclining a little forwards, and soon divides into three or four branches ; some of these are distributed to the vastus internus and cruræus muscles, and inosculate with the descending branches of the external circumflex artery ; the continuation of the original vessel descends along with the saphenus nerve to the knee, and there anastomoses with the internal articular arteries, and assists in supplying the synovial membrane and the integuments.

The anastomotica magna artery in some subjects is very large at its origin ; this, together with the great depth at which it lies from the surface, and its close connexion to the saphenus nerve, have caused it to be mistaken for the femoral artery in the operation of tying this vessel in the middle third of the thigh ; particularly where the limb has been injected with blood, the consequence of a punctured wound, and when the natural appearance of the parts has been found so completely changed as that they have been with difficulty recognized.

In amputation of the thigh in this situation, this artery should be secured; for, although it may not bleed at the time of the operation, yet, as its origin from the femoral artery is in general immediately above the situation of the ligature on the trunk, it may be the source of an alarming secondary hæmorrhage. In some subjects this artery is very small, and in many cases instead of one branch, the femoral or popliteal artery gives origin to several branches, which take the course of the divisions of the *anastomotica magna*.

Before the student should proceed to examine the popliteal artery, he should reflect on what practical inferences may be deduced from a knowledge of the relative anatomy of the femoral artery; he should first consider where this trunk can be most effectually compressed during life in performing amputation of the thigh or leg, or in any operation on the lower extremity in which we are desirous to command the circulation. Immediately below Poupart's ligament this artery is very superficially covered, and rests on the *psoas* muscle, which is here firmly supported by the *acetabulum* and the head of the *femur*; in this situation then the surgeon may with his finger, or with any firm substance, compress the femoral artery, so as to stop the flow of blood through it; it is not, however, in this situation that the *tourniquet* is ordinarily applied, for the circular strap of this instrument cannot be secured on the thigh higher than the lower edge of the *glutæus maximus*, or the fold of the *nates*, and this line is inferior to the *acetabulum* or to the

head of the femur ; hence the tourniquet cannot compress the artery opposite these resisting bodies, but is applied against this vessel where there is no support immediately behind it ; it is rather then, by the general circular compression forcing the surrounding parts against the artery, that the caliber of the latter is diminished by the pressure of the instrument ; this may explain why in many instances the tourniquet fails to command the circulation perfectly : it may be prudent, therefore, in any case where we are very anxious to prevent any loss of blood, to apply direct pressure on the femoral artery immediately below Poupart's ligament, or on the external iliac vessel immediately above this line, either with the thumb placed transversely, or with the handle of a large key or an office seal padded round with a little lint. In amputation of the leg, the femoral artery may be compressed in the middle third of the thigh ; in this case a small compress should be applied beneath the tourniquet over the line of this artery, and the pressure directed outwards, so as to compress the vessel against the femur on the inside of which it lies in this part of the limb.

The femoral artery may require to be tied in case of a wound, or of an aneurism of any of the principal arteries of the leg, of the popliteal artery, or of the femoral itself.

The femoral artery may be exposed and tied in the living subject in any part of its course, as must be the practice in case of a recent wound, or of diffused

aneurism the consequence of such : however, from the dissection which the student has made of this artery, he will perceive that this operation may be much more easily and expeditiously performed in some situations than in others.

The observations which have been made to prove the capability of the anastomosing branches around the hip-joint, to supply the lower extremity with blood, in case the external iliac artery had been obliterated, will equally apply to those cases in which the femoral artery is to become the subject of operation : if this vessel be obliterated above the origin of the profunda, the blood may, by the different anastomosing vessels before mentioned, pass into this artery, and so into the trunk of the femoral ; but should the profunda artery be obstructed, or the femoral, below the origin of this great branch, then the blood will pass, not directly into this trunk, but will descend through the long branches of the external circumflex artery on the anterior part of the limb to the articular arteries ; and posteriorly, through the different branches of the perforating arteries down to the popliteal artery.

The most frequent cause requiring a ligature on the femoral artery is popliteal aneurism. To Mr. Hunter is justly due the full merit of this improvement in the treatment of this disease ; he was the first who proposed to tie the artery at a distance from the aneurismal sac, and he first put this plan into practice on the femoral artery in a case of popliteal aneurism. The femoral artery may be tied in any part of its course ;

for the cure of popliteal aneurism, however, one of two situations is generally selected, either the middle third, or the superior third of the thigh; the former situation was that selected by Mr. Hunter, and may be named the inferior operation; the latter is that, which is now generally preferred for several reasons, and may be named the superior operation. I shall first describe the mode of performing both these operations, and shall afterwards contrast them, with the view of considering to which the preference should in general be given.

In the superior operation of tying the femoral artery, our object is to pass a ligature round this artery below the origin of the profunda, and in that part of its course in which it is very superficially covered, that is, between Poupart's ligament and the point at which the sartorius crosses the adductor longus muscle, and as near to this point as possible, that the circulation through the profunda artery may not interrupt the adhesive process at the seat of the ligature: this situation was first recommended by Professor Scarpa. In this operation the patient may be placed in a horizontal posture, the line of the sartorius muscle is to be then observed; this line will be more obvious if the limb be turned somewhat inwards; this expedient, therefore, may in the first instance be resorted to, in order to enable the operator to ascertain the course of this muscle: some authors recommend that the limb should be retained in this position; it appears to me, however, that the future steps of the operation will be facilitated if the limb be turned sufficiently outwards

so as to make this part of the thigh look a little forwards; in this position the artery when exposed will appear to be situated very superficially, whereas if the thigh be rotated inwards, the vessel will appear much more deeply seated. An incision is then to be made through the integuments about two inches and a half long, commencing about two inches below Poupart's ligament, or below the midpoint between the symphysis pubis and the spine of the ilium; this incision is to be continued downwards and inwards in the course of the artery, and along the inner edge of the sartorius; the saphena vein will lie on the internal side of this incision: not unfrequently, however, this vein receives two or three large branches in this part of its course, which come from the anterior part of the thigh; these branches are in danger of being wounded, but may be avoided by cautiously dividing the cellular membrane beneath the integuments. A director should next be insinuated beneath the fascia lata near the lower part of the wound, on which this aponeurosis is to be divided, to the extent of about an inch, the edge of the sartorius muscle will be then exposed; this should be pressed a little outwards. If the finger be now passed into the wound, the pulsation of the vessel will be felt; the artery, however, is not yet sufficiently denuded to admit of a ligature being passed around it, some dense cellular membrane covers it in this situation; this should be carefully divided on the director passed beneath it. A small portion of the sheath of the vessel is then to be elevated in the forceps, and divided by cautious touches of the knife held in a



horizontal direction. The vein is here behind the artery, and is not in general visible; part of it, however, may be sometimes seen on the inner side of the artery; the branches of the anterior crural nerve lie on its iliac side, but frequently one small nerve passes in front of the artery. The artery and vein are next to be separated from each other; this is often attended with some difficulty, owing to the intimate adhesion of their coats; a blunt instrument, however, such as the end of a blunt aneurism needle, or of an eye probe, may be insinuated between them; and should then be directed from within outwards, as the vein will thus be more perfectly secured from injury, and the nerves on the outer side of the artery can be easily avoided. The ligature having been tied, and one end cut close, the wound is to be gently closed by adhesive plaster, and the patient kept at perfect rest, with the limb in the flexed position, so as to avoid any tension on the vessel.

Although in the dead subject this operation may appear simple and easy of execution, yet in the living it is sometimes attended with considerable difficulty: if the patient be fat, or if there be any œdema in the limb, or if the thigh have become fixed in any unfavourable position, this operation may prove extremely difficult and embarrassing. When the coverings of the artery have been divided, the vessel will not in every instance pulsate, and the touch will often be unable to distinguish it from the surrounding parts. Nothing can more tend to render this operation difficult than neglecting to make a sufficiently free divi-

sion of the integuments. Wherever, therefore, we suspect that the coverings of the artery are thicker than usual, we should make the first incision proportionably longer. No attempt should be made to force the aneurism needle around the artery, until the vein and it have been clearly separated; these vessels often adhere so closely, that without due attention to this point, the extremity of the needle may be forced through the vein, and a portion of the latter be included in the ligature, which accident will most probably give rise to a fatal inflammation of the vein.

In the inferior operation of tying the femoral artery, our object is to pass a ligature round this vessel a little below the middle of the thigh, while the artery is covered by the sartorius, and immediately before it perforates the tendon of the triceps; this operation was first performed by Mr. Hunter. In this operation the patient should be placed in the horizontal posture, and the limb rotated outwards, an incision between three and four inches in length is then to be made through the integuments; this incision should commence about the centre of the thigh, and be carried perpendicularly down about an inch or an inch and a half from its internal margin, that is, nearer to the femur than to the internal edge of the thigh; the saphena vein is in danger of being wounded in this operation if the cellular membrane beneath the integuments be incautiously divided; this vein, however, will in general be found to be posterior or internal to the incision that has been now directed. Its situation and course may be previously ascertained by causing

its distention by applying pressure higher up in the thigh. This incision will be nearly parallel to the inner edge of the sartorius muscle, which muscle will be exposed by dividing the fascia lata of the thigh; the inner edge of the sartorius is then to be raised, and drawn gently outwards by a broad curved retractor. The strong fascia which covers the artery in the middle third of the thigh is now exposed, and must be next divided on a director insinuated behind it; unless this fascia be freely divided, it will be impossible to pass a ligature around the artery in this situation; when this aponeurosis has been cut through, the sheath of the vessels will be exposed, it here contains the saphenus nerve with the artery and vein; the nerve lying on the anterior and external part, and the vein behind the artery, the nerve may be drawn outwards with a blunt hook, and the aneurism needle must be cautiously insinuated between the vein and artery, directing it from within outwards.

This operation will be found much more difficult to perform than that last described, the sartorius muscle is sometimes so broad in this situation that its edge is not immediately exposed when the integuments have been divided; the fascia behind this muscle also increases the difficulty, for when the sartorius has been raised, this aponeurosis prevents the operator feeling the pulsation of the artery: and should he proceed to search for it near the inferior part of the incision, he may mistake the *arteria anastomotica magna* for the trunk of the femoral. In this situation the femoral artery lies at a great depth from the surface, particu-

larly if the natural relations of the parts should be at all altered by disease or by an effusion of blood, as in cases of a wound of the artery ; in this inferior operation also the surrounding parts must suffer more or less of violence or displacement ; this will probably induce deep-seated inflammation, which may lead to the formation of matter beneath the fascia of the thigh, or beneath the sartorius muscle ; this will not only excite great symptomatic fever, but may also tend to induce ulceration in the coats of the artery above the ligature, and so give rise to secondary hæmorrhage. There is no advantage with regard to a greater number of anastomosing vessels being preserved by tying the artery thus low down in the thigh ; for on the profunda, after either operation, the principal dependence must be placed for the supply of blood to the limb, when the main artery has been obliterated, and in the superior operation the ligature is applied below the origin of this branch. Against the superior operation it has been urged that the saphena vein is in danger, and that the lymphatic vessels of the lower extremity are liable to be injured. The saphena vein, however, may be avoided, by first ascertaining its course and situation, and experience proves that the fear of injuring the lymphatics is not a well-founded apprehension.

The femoral artery may require to be tied in the inguinal region, near to Poupart's ligament, above the origin of the profunda, in case of a wound or aneurism of the femoral artery or of the profunda, or in the event of secondary hæmorrhage succeeding to the operation first described. To tie the femoral artery

immediately below Poupart's ligament, the patient should be laid in the horizontal position, the limb extended and rotated outwards as much as the circumstances of the case will permit, then commence an incision about an inch above Poupart's ligament, and continue it in the line of the artery to the distance of two inches below this ligament; the layers of the superficial fascia are then to be divided to the same extent: if any considerable arterial branches bleed they should be tied, the lymphatic glands may be pushed to either side; if diseased (as they not unfrequently are in case of aneurism) they will be found to add to the difficulty of the operation, and it may be necessary to remove one or two of them. The fascia lata is next to be divided, and the sheath of the femoral vessels opened in the same manner as before directed; the vein here lies to the pubic side of the artery; around the latter the aneurism needle is to be then directed from within outwards; the anterior crural nerve is not exposed in this operation, as it lies external to, and deeper seated than the artery.

In some subjects the profunda arises very high, and it and the femoral artery will appear of equal size and equally superficial, so that it may be difficult when these vessels are exposed in the living subject to discriminate one from the other: the profunda artery, however, is the most external of the two; by alternately pressing these two vessels, at the same time examining the aneurismal tumour or the bleeding from the wound, we may be enabled to ascertain which is the femoral and which is the profunda, or

which of these two vessels is connected with the disease or wound which has required the operation ; and should no particular circumstance forbid, we may include only one artery in the ligature.

Excepting the irregularities already noticed in respect to the origin of the circumflex, and the arrangement of the perforating and other small muscular branches of the profunda and femoral arteries, but few deviations of any importance occur in the course of the femoral itself, or in the place of its division into its two terminating branches. In this respect the blood vessels in the inferior extremity differ materially from those in the superior, in the latter the disposition to variety is frequent, whereas the femoral artery is almost constant in its course and in the place of its division. Cases, however, have occurred, in which, analagous to the high division of the brachial, the femoral artery has been found to have been divided into the tibial and fibular arteries so high as the groin : in some cases too of high division of the femoral artery, the branches have united before their arrival at the poplitæal space ; this arrangement, which has its frequent parallel in the upper extremity, is important to recollect, as it might lead to an unsuccessful result to the operation of tying the femoral artery for the cure of poplitæal aneurism.



## ARTERIA POPLITEA.

THE continued trunk of the femoral having passed through the opening in the triceps, receives the name of popliteal artery, and takes an oblique course downwards and outwards to the lower edge of the poplitæus muscle, where it divides into the anterior and posterior tibial arteries; through this extent the artery lies in the popliteal space, to the anatomy of which region the student should now direct his attention.

The subject being laid on the face, the integuments should be removed from the inferior third of the thigh and superior third of the leg, a small vein (the posterior saphena) is generally exposed at the inferior part of this dissection; this vein ascends from the back part of the leg and joins the popliteal vein, it is generally accompanied by a small nerve, (communicans tibialis;) the fascia lata must be next removed to the same extent as the integuments; this aponeurosis is very tense in this region, being strengthened by strong transverse bands which serve to bind together the lateral boundaries of this space. The popliteal space occupies about the inferior third of the thigh, and the superior fifth of the leg: it is bounded internally by the semi-membranosus, semi-tendinosus, and internal head of the gastrocnemius muscles; externally by the biceps, plantaris, external head of the gastrocnemius and solæus muscles; it terminates above

and below in a point or angle, so that the whole region is somewhat of an oval or diamond figure.

The popliteal space contains a considerable quantity of adipose substance, also the posterior crural nerve, and the popliteal artery and vein; the nerve is most superficial, and rather to the external side of the medial line; about the upper part of the popliteal space this nerve usually divides into two branches, the posterior tibial and the peroneal; the latter takes the direction of the biceps tendon, the former descends nearly in the middle line. If the fat which is beneath the nerve be now removed, the popliteal vessels will be exposed; the vein is most superficial, and a little to the outer side of the artery, the latter is nearer to the bone, from which it is separated by some fat, and sometimes by a lymphatic gland. The popliteal artery may now be seen to take an oblique course downwards and outwards, it lies to the inner side of the popliteal space above, but below it is nearly in the centre.

In this course the popliteal artery is covered superiorly by the semi-membranosus muscle, in the middle by the integuments, fascia, adipose substance, and by the popliteal vein; inferiorly it is overlapped by the heads of the gastrocnemii muscles, and crossed by the posterior tibial nerve. In the superior part of this region the artery lies on the posterior surface of the femur; in the middle, on the posterior ligament of the knee-joint; and inferiorly, on the popliteus muscle: the popliteal vein is intimately attached to the artery through the entire course, and lies superficial and

somewhat external to it ; the sciatic nerve is still more superficial and more external to it in the upper part of this region, but inferiorly the posterior tibial nerve lies to the inner or tibial side of the artery ; a great number of muscular branches of this nerve however lie around the artery, and are so closely connected to it, as to account for the numbness, impaired muscular power, and sometimes pain, which attend an aneurismal tumour in this region.

Above the flexure of the knee-joint there are generally three or four lymphatic glands imbedded in the adipose substance around the artery ; one of these is placed on either side of the artery, one usually lies superficial to this vessel, and sometimes one is situated between it and the bone : if these glands become inflamed and suppurate, or if they remain enlarged and indurated, the tumour which they form may have the pulsation of this artery communicated to it, and so resemble an aneurism : in some instances, particularly if the disease have been of long duration, it will require a careful examination to discriminate between them. This examination will be much facilitated if the different muscles which bound this region be put into a relaxed position ; we can then insinuate our finger into the popliteal space, so as to ascertain the exact situation or attachment of the tumour, also its mobility and how far pressure can alter its size. By directing an assistant alternately to compress and to leave free the femoral artery, we may judge whether any change occurs in the form of the tumour, or whether its size or tension undergoes any alteration or increase.

The popliteal artery gives off a great number of branches, they are all small and of little practical importance except in assisting to establish collateral circulation in case the femoral or popliteal artery has been obliterated. It first sends off several muscular branches to supply the muscles on the back part of the thigh; it next gives off the *articular* arteries; these supply the knee-joint, are five in number, and are distinguished by the names of 1. *superior internal*, 2. *superior external*, 3. *azyga*, 4. *inferior external*, and 5. *inferior internal*; lastly, the popliteal artery gives off several muscular branches to the heads of the gastrocnemii and solæi muscles.

1. RAMI MUSCULARES SUPERIORES, are two or three in number; they are distributed to the biceps, semi-tendinosus, and semi-membranosus muscles, some perforate the biceps and enter the vastus externus, others anastomose with the branches of the perforating arteries.

2. ARTERIA ARTICULARIS SUPERIOR EXTERNA, arises from the outer side of the popliteal artery, and passes upwards and outwards above the external condyle of the femur, and beneath the tendon of the biceps; this artery then turns round to the anterior part of the femur, and divides into a superficial and deep branch; in this course it supplies the external head of the gastrocnemius, the biceps and vastus externus muscles. The superficial branch then runs through the vastus externus to the patella, and ramifies on this bone; the deep branch supplies the synovial membrane, and sends several branches into the substance of the

femur, just where the cartilage commences. Several branches of this artery inosculate with the inferior external articular artery below, and with branches of the external circumflex above.

3. *ARTERIA ARTICULARIS SUPERIOR INTERNA*, arises from the inner side of the popliteal artery, and above the internal condyle of the femur; it runs close to the bone, and behind the tendon of the vastus internus and adductor magnus muscles; it then divides into superficial and deep branches, the former pass through the vastus internus to the patella, and anastomose with the *anastomotica magna* and with the external articular artery; the deep branch supplies the synovial membrane and the substance of the bone.

4. *ARTERIA ARTICULARIS MEDIA VEL AZYGÆ*, arises from the anterior part of the popliteal artery, opposite the bend of the knee-joint; it then passes through the *ligamentum posticum*, and divides into several branches, which supply the synovial membrane, the crucial ligaments, and the adipose substance at the back part of the joint.

5. *ARTERIA ARTICULARIS INFERIOR EXTERNA*, arises from the popliteal artery below, or rather opposite the angle of the knee-joint; this artery passes outwards, and is covered by the *plantaris*, and by the external head of the *gastrocnemius* muscle, also by the external lateral ligament; it turns round the outer side of the joint, above the head of the fibula, along the external semilunar cartilage, as far as the patella; in this course it supplies the joint and the different muscles it passes by; its branches anastomose with

the other articular arteries, and with the anterior tibial recurrent.

6. *ARTERIA ARTICULARIS INFERIOR INTERNA*, arises from the inner side of the popliteal artery, inferior to the last described branch; this artery runs downwards and inwards below the internal condyle of the tibia, and then turns round to the anterior surface of this bone, passing behind the internal lateral ligament and the tendons of the flexor muscles: this artery then divides into several branches, which supply the head of the tibia, the ligamentum patellæ, and the subjacent adipose substance.

7. *RAMI MUSCULARES INFERIORES*, arise from the popliteal artery below the joint; they are three or four in number, they sometimes arise separately, and sometimes by one or two common trunks, which soon subdivide into several branches: these descend obliquely, and enter the gastrocnemii muscles; these branches can be traced along the anterior surface of these muscles a considerable way, even to the common tendon of the gastrocnemii and solæi; some long branches of these arteries also descend in the integuments on the back part of the leg, as far as the heel.

Before the student proceeds to dissect the branches into which the popliteal artery divides, and which supply the leg, he should reflect on what practical deductions may be drawn from considering the situation and connexions of this trunk. Although this artery lies very deep in the popliteal region, yet it may become the subject of operation.

The popliteal artery may require to be tied in case



of a wound of it or of the posterior tibial artery, or of aneurism of this latter vessel, situated high in the leg. The student should consider the distance of the popliteal artery from the surface in different parts of this space, and in different subjects. In the dead subject this artery may be exposed without much difficulty, either in the superior or inferior part of its course ; but, about the middle of the popliteal space it is extremely difficult to do so.

In order to pass a ligature around the popliteal artery in the upper part of its course in the living subject, the patient may be placed either in the horizontal position on his back, with the thigh laid on its outer side and the leg bent, or he may be laid on his face and the limb extended ; in either position an incision of about three inches should be made through the integuments, along the posterior or external margin of the semi-membranosus muscle, the fascia lata is to be divided to the same extent, and then by raising or drawing inwards the edge of the semi-membranosus, the finger will directly feel the pulsation of this artery. The posterior crural nerve is in this situation so far to the outer or fibular side, that it is not endangered in the operation ; the vein is to be cautiously separated from the artery, and pressed to the outer side, the aneurism needle may then be insinuated between it and the artery, and carried round the latter from without inwards. On the dead subject this operation is not attended with much difficulty, and appears nearly as practicable as the Hunterian operation

on the femoral artery, but neither can be compared with the high operation as advised by Scarpa.

If we attempt to expose this artery in the middle division of the popliteal space, we shall find considerable difficulty; the vessel here lies so deep, and the sides of this space are so tense, as to render it very difficult to separate them from each other, particularly if the limb be extended; and if we bend the leg, that the muscles may become relaxed, we shall impede our view of the deep-seated parts.

In order to pass a ligature around the artery as it lies between the heads of the gastrocnemii, the patient should be laid on his face, and the limb extended: the situation of the artery may be ascertained by feeling its pulsation; an incision about three inches long should then be made parallel to the middle line, commencing opposite the bend of the knee-joint; when the integuments and fascia have been divided, the posterior saphena vein and its accompanying nerve will be exposed; these should be carefully drawn to either side, and then by separating some dense cellular membrane, the popliteal artery and vein and the posterior tibial nerve, will be brought into view as they are descending between the heads of the gastrocnemii muscles. Some of the inferior muscular branches of the popliteal artery will in all probability be divided in this part of the operation; they should be immediately secured. If an assistant now flex the leg a little, and press to either side the heads of the gastrocnemii muscles, the surgeon will be able to separate the artery from the surrounding parts; the posterior

tibial nerve should be drawn inwards and the vein outwards, the aneurism needle may then be insinuated between the vein and artery, and carried round the latter from without inwards, taking care to avoid including the nerve in the ligature. Although I have thus considered the best mode of exposing this artery in different situations in this region, yet, I conceive, that such an operation can never be required in any case except of recent wound, in which, as I have often remarked before, the surgeon is to be guided by the extent and direction of the injury, as much as by his anatomical knowledge; in aneurism in this region no surgeon now thinks of opening the popliteal space.

In the living subject, if we flex the leg, we can feel the pulsation of this artery near the middle of the popliteal space: in case of amputation of the leg or foot, this artery may be compressed by the tourniquet in this situation; the compress should be so small as to admit of being insinuated between the hamstring muscles, and should be pressed a little inwards: compression thus applied is sometimes attended with a greater degree of pain than the patient can endure, and it is seldom as effectual as if applied on the femoral artery.

In cases of obliteration of the poplitæal artery and of the continued femoral, the usual result of the operation for the cure of poplitæal aneurism, the articular and muscular branches of the poplitæal become much increased in size, and through their free communications with the muscular arteries in the thigh, as also

with those in the leg, the circulation through the latter is in some time freely established.

The student may now proceed with the dissection of the arteries of the leg: the subject may be placed in the same position as was recommended in the dissection of the popliteal artery; the gastrocnemii muscles should be divided a little below their origin, and by removing some dense cellular membrane and several veins, the popliteal artery will be seen dividing into its two branches a little above the lower edge of the poplitæus and the superior fibres of the solæus muscles. The posterior tibial artery is the larger of the two, and appears, from its direction, as the continuation of the popliteal. This is the usual place of division, it sometimes, however, occurs higher in the poplitæal space: I have seen it in one instance take place between the condyles of the femur, in which case the two arteries proceeded close together to the usual place of separation, and the anterior tibial gave off the inferior external articular artery: in some cases the anterior tibial is so small, that the poplitæal can scarcely be said to divide, but is rather continued on as the posterior tibial, which in its course down the leg will give off branches corresponding to, and answering the purposes of the anterior tibial and peronæal arteries,

## ARTERIA TIBIALIS POSTICA.

THIS is an artery of considerable size, it extends from the edge of the poplitæus muscle to the fossa between the inner ankle and the heel, where it divides into the internal and external plantar arteries, which supply the muscles and integuments of the sole of the foot and toes.

To expose this artery, the student may detach the internal head of the solæus from the tibia, and turn it, together with the gastrocnemii towards the fibula; or these superficial muscles may be cut across, and not separated from the bone: beneath these muscles we find a very strong fascia, covering the posterior tibial nerve and vessels, and binding down the deep-seated muscles, this fascia is partly continuous with that which is derived from the poplitæus and from the tendon of the semi-membranosus muscle. Near the centre of the upper extremity of the solæus is a well defined semilunar opening, whose tense and tendinous border defends the vessels in their passage through it, from the superincumbent muscles.

The posterior tibial artery descends in an oblique direction from the middle of the leg to the centre of the fossa between the heel and inner ankle; about the middle of the leg it is half an inch from the edge of the tibia. This artery in this course is accompanied by two veins, one on either side, also by the posterior tibial nerve; in the upper part of the leg this nerve lies to the inner or tibial side of the artery, it soon, however, passes over it; and inferiorly it lies to its outer or fibular side.

The posterior tibial artery is covered in the upper and middle thirds of the leg by the gastrocnemius and solæus muscles, but in the lower third only by the integuments and by the superficial and deep layers of the fascia of the leg. In the upper third of its course this artery lies on the tibialis posticus muscle, in the middle third it rests on the flexor digitorum communis, and in the inferior third some fat and cellular membrane separate it from the tibia and from the internal lateral ligament of the ankle-joint.

In the inferior third of the leg the posterior tibial artery runs nearly parallel to the inner edge of the tendo achillis; between the os calcis and malleolus internus, the tendons of the tibialis posticus, flexor digitorum communis, and flexor pollicis proprius, accompany the posterior tibial artery and nerve, these several parts lie in this internal malleolar region in the following order: the tendons of the tibialis posticus and flexor digitorum communis run close to the malleolus internus; about a quarter of an inch behind these is the posterior tibial artery, on each side of which is a vein; a little behind these is the posterior tibial nerve, and about half an inch nearer to the heel is the tendon of the flexor pollicis proprius. At the inferior and anterior part of this fossa, between the origins of the adductor pollicis muscle, the posterior tibial artery divides into the internal and external plantar arteries, the description of which may be deferred until the branches of the posterior tibial artery in the leg have been examined.

The posterior tibial artery immediately after its origin gives several branches to the poplitæus, solæus,



and gastrocnemii muscles, also to the upper extremity of the tibia, and about an inch below the poplitæus it gives off the *peronæal or fibular artery*. This is the only branch of any name, size, or importance, which the posterior tibial artery sends off in its course down the leg; the student should, therefore, trace this before he examines the other branches of the posterior tibial artery.

## ARTERIA PERONÆA.

THIS artery arises from the posterior tibial, about an inch below the poplitæus muscle; it descends at first parallel to the tibial artery, but is soon separated from it by the posterior tibial nerve; it then inclines outwards towards the fibula, and descends between the internal margin of this bone and the flexor pollicis proprius, as far as the external ankle. The peronæal artery at first lies on the tibialis posticus muscle, through which it passes, and then runs in a groove near the interosseous margin of the fibula, and distributes several branches to the muscles which are connected to this bone, particularly to the flexor pollicis proprius; it also sends branches into the substance of the bone, and gives off several long branches which pass outwardly to the peronæi muscles and to the integuments.

About the inferior third of the leg the peronæal artery divides into two branches, which are named the anterior and posterior peronæal arteries.

I. ARTERIA PERONÆA ANTERIOR pierces the interosseous ligament and runs to the anterior surface of

the fibula, beneath the peronæus tertius muscle, about two inches above the malleolus externus; it then divides into numerous branches which pass downwards and inwards beneath the extensor tendons, and anastomose with the external malleolar artery, a branch of the anterior tibial; from this anastomosis branches descend over the synovial membrane of the joint, and communicate with different arteries on the tarsus. The anterior peronæal artery in some instances is very small, while in others it is of considerable size: when this artery is unusually large, we find that when it has passed through the interosseous ligament, it inclines downwards and inwards, and joins the trunk of the anterior tibial artery; in such cases this last named vessel will be found very small, and will appear almost exhausted when it has arrived near the ankle, and then the anterior peronæal will take its place, and supply its deficiency.

2. ARTERIA PERONÆA POSTERIOR, appears as the continuation of the fibular artery in direction and in size; it descends behind the inferior extremity of the fibula, to the external side of the os calcis. In this course the posterior fibular artery gives off several branches to the flexor communis, flexor pollicis, and peronæus longus and brevis, it also sends branches to the back part of the ankle-joint, and one or two branches take a transverse course inwards towards the tibia, and join the posterior tibial artery.

This artery is accompanied by the communicans tibialis nerve around the external malleolar region, the nerve lying superficial; when the artery has arrived at the external side of the os calcis, it divides into

numerous branches, some of which are distributed to the adipose substance about the heel, and anastomose with the posterior tibial artery; others pass on to the sole of the foot, and inosculate with the external plantar artery; and some turn over the outer margin of the foot, and communicate with the tarsal branches of the anterior tibial artery.

The trunk of the peronæal artery is often absent, its place being then supplied by branches from the posterior tibial artery: on the other hand it is sometimes very large, and at the lower part of the leg will supply the place of the latter.

The student may now examine the remaining branches of the posterior tibial artery. In its course down the leg the posterior tibial artery gives one or two large branches which enter the tibia by a canal, which commences above its centre, and leads obliquely downwards into the substance of the bone; it also sends numerous branches to the muscles, both deep and superficial; these branches have received no particular names; many of them communicate with the peronæal artery, and several long branches pass to the integuments on the posterior and internal part of the leg, some of which unite with branches of the anterior tibial artery. Near the os calcis several branches of considerable size are distributed to the fat behind the tendo Achillis and about the heel, these branches communicate with the peronæal artery; several also run to the muscles in the sole of the foot, and some turn upwards and forwards, ramify on the malleolus internus, and anastomose with the anterior tibial artery.

Previous to examining the arteries in the sole of the foot, the student should re-consider the relative anatomy of the posterior tibial artery in its course down the leg. This artery is exposed to accidents, and at the same time favourably circumstanced for operation only in the inferior third of its course, being covered in the two upper thirds by the internal gastrocnemius and solæus muscles.

The posterior tibial artery may require to be tied in case of a wound in the sole of the foot, which has divided some large artery in that region; also in case of a wound behind the internal ankle, in which the posterior tibial artery itself has been injured, or in case of aneurism in consequence of this wound. When aneurism of the posterior tibial artery is seated high up in the leg, it will be necessary to tie either the popliteal or femoral artery. In case of wounds in the sole of the foot, in which we require to tie the posterior tibial artery, the most favourable situation is between the malleolus internus and the heel: to expose the artery in this situation in the living subject, we should make a semilunar incision of two inches and a half in length through the integuments, commencing near the tendo Achillis, and continuing it downwards and forwards nearly midway between the heel and ankle, a little nearer to the latter. The integuments being divided the fascia of the leg is exposed, which must be cut to the same extent; a little cellular membrane must be now removed, and a very strong aponeurosis is exposed; this is the continuation of the fascia covering the deep muscles of the leg; in this situation it is very tense, it adheres to the sheaths of

the tendons, and covers the vessels and nerves in this region; this fascia must be cautiously divided, and the sheath of the vessels will be exposed; this being opened, the venæ comites are to be separated from the artery, and the aneurism needle carefully passed round the latter, directing it from the heel towards the ankle to avoid the nerve, which in this situation is sometimes very large, and close to the artery.

If the posterior tibial artery be itself wounded in this situation, it may be exposed either at the wound or higher up, in the inferior third of the leg, by making an incision of about two inches and a half long at the inner side of, and parallel to, the tendo Achillis; the two layers of fascia of the leg are to be divided, and the remainder of the operation conducted in the same manner as in that last described.

In case of secondary hæmorrhage after this operation, or in case of aneurism of the posterior tibial artery forming in consequence of a wound of the artery in this situation, it may be necessary either to tie this vessel higher up in the leg, or to tie the popliteal or femoral artery itself; it has been deemed prudent to give the patient the chance of success from the former operation before having recourse to so severe and hazardous a measure as that of tying the femoral or popliteal artery.

This operation of tying the posterior tibial artery in the middle of the leg will be found much more difficult than either of those described, as this vessel here lies at such a depth from the surface, and is covered by the gastrocnemius and internal head of the solæus,

which in this situation is attached to the tibia. To expose the artery here then, the leg should be bent, the foot extended, and both placed on the outer side; make an incision about four inches in length along the inner edge of the tibia, through the integuments and fascia, (the internal saphena vein should be avoided,) the edge of the gastrocnemius muscle will be exposed, this may be easily raised and drawn to the outer side; a director must then be insinuated beneath the inner head of the solæus, on which this muscle must be divided from its attachment to the tibia: the deep fascia of the leg is here very tense and strong, binding down the deep-seated muscles and the tibial nerve and vessels; this must be cautiously divided on the director passed beneath it. The foot should now be extended as much as possible, and the knee placed in the flexed position, to relax the superficial muscles on the back part of the leg; the artery may be now felt pulsating about an inch from the edge of the tibia; the veins are then to be separated from the artery with a blunt instrument, and the aneurism needle passed round the latter in a direction from without inwards, so as to avoid the posterior tibial nerve.

On the dead subject this operation is not attended with much difficulty; in the living, however, the case is very different, the muscles are then rigid and unyielding, and when the fascia which covers them is divided they leave their natural situation and become much elevated, so as to make the situation of the artery appear as a deep cavity, at the bottom of which the vessel is placed.



The first case in which I saw this operation performed was by Mr. Travers in St. Thomas's hospital, on a man who had been wounded by a small chisel a little above the ankle; the artery had been tied at the wound, but secondary hæmorrhage ensuing, it was considered necessary to tie the artery in the middle of the leg: the man was very robust and muscular, and there was considerable difficulty in exposing this vessel; the operation, however, ultimately proved successful. I have known three other cases of this operation, each of which, though attended with considerable difficulty, ultimately proved successful.

It may be requisite to tie this artery in cases of wounds also in this situation, which have penetrated the muscles; in such a case the extent and direction of the wound must guide the surgeon in the several steps of the operation; it will not of course then be necessary to perform the same dissection, or to separate the solæus from the tibia, as recommended in the foregoing page, but merely to enlarge the wound and to divide any muscular fibres that may obscure the bleeding vessel. In case of aneurism, however, or of secondary hæmorrhage requiring the artery to be secured in the middle of the leg, I should prefer exposing it in the way before mentioned, than by cutting down through the muscles of the leg in the direction of the vessel, as recommended by some, particularly Mr. Guthrie, who describes the mode of performing this operation as follows: "the first incision six inches, should be made nearer to the inner edge of the leg, than to the centre, and should be

carried through the gastrocnemius muscle, plantaris tendon and solæus muscle, down to the fascia, under which the artery lies with its accompanying veins, having the posterior tibial nerve to the fibular side. If the incision have been made in the upper part of the calf of the leg, the peronæal artery will be exposed by it: but if the peronæal artery be the vessel injured, the incision should be made towards the fibular side of the leg: and when the surgeon divides the fascia, he will find the artery covered by the fleshy fibres of the flexor pollicis longus muscle, at any distance below three inches and a half from the head of the fibula: and which fibres must be divided, when the artery will be found close to the inside of the bone. Above that part the artery is under the fascia, and upon the tibialis posticus muscle. It has not an accompanying nerve. Both arteries will be readily found, by either of the incisions described, if the surgeon is acquainted with their situation."

As I have before remarked, in cases of wounds in the calf of the leg, particularly gunshot, attended with hæmorrhage, it will be advisable to enlarge the wound in the proper direction, and cut through the muscles, &c., so as to expose the bleeding vessels, the foregoing directions, therefore, will not apply or prove of much service in such cases; but should the operation of tying the posterior tibial artery be required for aneurism or secondary hæmorrhage, the consequence of an injury lower down, I should still much prefer the operation I have first described to that recommended by Mr. Guthrie, the advantages of which in any point of

view I cannot discern or appreciate : as to the peronæal artery, I have not known the operation of tying it in the upper part of the leg to have ever been required except in case of recent wound.

The student may now proceed to trace the internal and external plantar arteries, the divisions of the posterior tibial.

The foot being placed in a convenient situation, remove the integuments from its inferior surface and from the toes ; in this dissection numerous small arteries must be divided, particularly about the heel ; these branches supply the integuments and subjacent adipose substance, which is very abundant in this situation ; it is also very vascular, and presents a peculiar granulated appearance ; this substance is closely attached to the plantar aponeurosis, to the structure and attachments of which the student should next attend. The plantar fascia is very strong and tendinous ; it extends from the os calcis and from the depressions on each side of this bone, forwards to the toes, and opposite the first phalanx of each, it divides into two fasciculi of fibres, which are inserted into the sheaths of the flexor tendons, and into the sides of the capsular ligaments connecting the metatarsal bones to the first phalanges. This aponeurosis is much stronger posteriorly, particularly in the centre, than anteriorly. Opposite the phalanges of the toes, where this aponeurosis is separating into different fasciculi, we may observe strong bands of fibres crossing these in a transverse direction. The student may now raise this aponeurosis and dissect the superficial layer of

muscles, namely, the flexor digitorum brevis in the centre, the abductor pollicis internally, and abductor minimi digiti externally: these muscles he may either raise from their origin and turn towards the toes, or merely divide a sufficient number of their fibres to expose the deeper-seated parts.

Between the origins of the abductor pollicis muscle, the posterior tibial artery divides into the internal and external plantar arteries; the former is the smaller of the two, and runs a more superficial course.

#### ARTERIA PLANTARIS INTERNA.

THIS artery runs along the inferior and internal side of the tarsus, above the abductor pollicis muscle, as far as the first phalanx of the great toe, where it divides into two or three branches, which supply the integuments of this toe. In this course the internal plantar artery sends many branches to the abductor and flexor pollicis brevis, to the articulations of the tarsus, and to the integuments; several branches also turn over the side of the foot, and anastomose on the tarsus and metatarsus with branches from the anterior tibial artery; near its termination it often inosculates with the external plantar artery, so as to form a *superficial plantar arch* of arteries.

#### ARTERIA PLANTARIS EXTERNA,

Is much larger than the internal plantar, and appears the continued trunk of the posterior tibial. The external plantar artery pursues a tortuous course across the foot, first running downwards and outwards, as far

as the metatarsal bone of the little toe, and then turning in a transverse direction inwards and upwards, to the cleft between the metatarsal bones of the great and second toe, where it terminates in a free inosculation with the anterior tibial artery. This course which the external plantar artery takes, is denominated the *great plantar arch* of arteries. The external plantar artery from its origin to the metatarsal bone of the fifth toe is covered first by the abductor pollicis, and next by the flexor digitorum brevis; it lies inferior to the flexor tendons and to the accessory muscle; from the base of the metatarsal bone the artery runs forwards for a short distance, between the flexor digitorum brevis and abductor minimi digiti; the artery in this straight part of its course lies very superficial in children, and is frequently wounded, being here only covered by the integuments and plantar fascia. As the plantar artery bends across the metatarsal bones, it passes very deep among the muscles of this region, and in this part of its course it is covered by the tendons of the flexor digitorum longus and brevis, and by the lumbricales, and lies between the abductor pollicis and transversalis pedis; having arrived at the base of the metatarsal bone of the great toe, it is joined by the anterior tibial artery, and thus the plantar arch of arteries is formed; this arch extends from the base of the metatarsal bone of the little toe, to that of the great toe; the concavity of this arch looks backwards and inwards, the convexity forwards and outwards.

The external plantar artery, between its origin and the commencement of the plantar arch, sends nume-

rous branches to the different muscles in the sole of the foot; many of these must be divided in exposing the trunk of the artery; these muscular branches are of considerable size, particularly those near the os calcis, several of which pass to the integuments: these arteries anastomose with each other, and with branches of the posterior peronæal and internal plantar arteries.

From the plantar arch several arteries arise; from its concavity many small branches proceed to the muscles and integuments of the sole of the foot; from its superior surface three or four branches arise, and are named *perforating arteries*; they supply the interossei muscles and anastomose with the metatarsal branches of the anterior tibial artery. From the convexity of the plantar arch four long branches proceed, named the *digital arteries*.

The *first digital artery* arises opposite the metatarsal bone of the little toe, and proceeds along its fibular side, beneath its abductor and short flexor muscles, to its last phalanx, where it turns towards the centre and meets a corresponding branch from the next artery.

The *second digital artery* arises a few lines internal to the last, and runs along the interossei muscles to the cleft between the fifth and fourth toes; it here receives a small branch of the metatarsal artery from the interosseous space, and then divides into two long branches which proceed along the opposed sides of these toes to their last phalanges, where they terminate in a manner similar to that first described.



The *third digital artery* arises at a little distance beyond the last, and runs to the cleft between the fourth and third toes, where it divides into two long branches, which run in a manner similar to the former.

The *fourth digital artery* arises internal to that last described, and running to the cleft between the third and second toes, divides into two branches, which have a similar course and termination to those last described.

The external plantar artery having arrived at the cleft between the metatarsal bones of the second and first toes, receives the communicating branch from the anterior tibial artery, and thus completes the plantar arch of arteries. All the digital arteries of the toes run in a manner similar to those of the fingers, on the inferior and lateral surface of the phalanges; they are accompanied by the digital nerves, these twine around the arteries, and run with them to the last phalanges; the arteries here increase in size, and those of opposite sides unite with each other in the manner of an arch; these arteries in this course supply the integuments of the toes, the flexor tendons and their sheaths, and from their ultimate anastomosis on the last phalanx numerous branches proceed to the integuments and cellular tissue at the extremity of each toe. The great toe and the internal side of the toe next it, are supplied with blood from the anterior tibial artery; the external side of the second, and both sides of the other toes, are supplied by the external plantar arteries.

From the peculiar structure of the integuments and aponeurosis of the foot, superficial wounds in this situation frequently bleed very smartly; there is often great difficulty in exposing the bleeding vessel, so as to apply a ligature around it; and if we enlarge the wound with a view of facilitating this object, we only increase the difficulty, for we shall probably open several other vessels, which may bleed as much as that originally wounded. In such a case, if compression carefully applied fail to stop the hæmorrhage, it will be necessary to tie the trunk of the posterior tibial artery as this vessel is passing through the fossa between the heel and the internal ankle. If, however, the external plantar artery be wounded opposite the base of the little toe, it may be more fully exposed by enlarging the wound, as it is very superficial in this situation: both ends of the opened vessel must be tied in consequence of the proximity of the inosculation with the pedial or the anterior tibial artery.

## ARTERIA TIBIALIS ANTICA.

FROM the division of the popliteal artery, the anterior tibial immediately passes forwards between the fibres of the tibialis posticus muscle, and close to the neck of the fibula, through the interosseous space above the interosseous ligament, and below the head of the tibia; it then descends on the anterior surface of the interosseous ligament and of the tibia, passes over the ankle-joint, and then runs forwards on the superior surface of the tarsus to the cleft between the first and second metatarsal bones, where it divides into its two last branches. To trace this artery throughout this course the limb should be placed upon its posterior surface; remove the integuments from the anterior surface of the leg and foot, and divide the fascia of the leg so as to expose the extensor muscles; then commence at the upper part of the leg to separate the tibialis anticus from the extensor digitorum communis, and the artery with its two venæ comites will be brought into view, lying at first on a few fibres of the tibialis posticus, and afterwards on the interosseous ligament near the neck of the fibula; with very little dissection this vessel may now be traced through the remainder of its course.

A line drawn from the head of the fibula to the base of the great toe will be parallel to the course of this artery. In the superior third of the leg the anterior tibial artery lies between the tibialis anticus and ex-

tensor digitorum communis muscles, in the middle third it is between the tibialis anticus and extensor pollicis longus; in these two divisions of the leg it rests on the interosseous ligament and is covered by the muscles which lie on either side. In the inferior third the artery advances a little forwards, and lies on the tibia between the tendons of the extensor digitorum communis and extensor pollicis proprius, the latter overlaps the artery: in this part of its course it is covered only by the integuments and fascia of the leg; in the living subject, however, it is by no means so superficial in this situation as might be supposed from examining it in the dead subject, for the tendons on either side bear off the integuments from the vessel to such a distance, that if these be divided, the artery will appear much deeper-seated than it does in a dissected limb, or in a dry preparation.

The anterior tibial artery having arrived at the inferior end of the tibia, passes anterior to the synovial membrane, and behind the annular ligament of the ankle-joint, it then runs over the astragalus, navicular, and internal cuneiform bones, to the base of the metatarsal bone of the great toe; in this part of its course it is only covered by the integuments, and about the middle of the tarsus it is crossed by the internal tendon of the flexor digitorum brevis.

The anterior tibial artery is accompanied by two veins, one on either side, and by a small nerve, a branch of the fibular or peronæal; this nerve attaches itself to the artery above the middle of the leg, and accompanies it to its termination; the nerve lies su-

perforial to the artery, but it frequently changes its situation from one side to another. Between the first and second metatarsal bones the anterior tibial artery sinks into the interosseous space and divides into two branches.

The anterior tibial artery throughout its whole course gives off several branches; as it is passing between the tibia and fibula it sends several small arteries to the tibialis posticus muscle; having passed through the interosseous space it gives off the recurrent artery; as it descends on the interosseous ligament it sends numerous branches to the muscles on either side: near the ankle it gives off the malleolar arteries, one to either side; as it passes over the tarsus and metatarsus it sends a branch to the bones composing each of these regions, and at the cleft between the metatarsal bones of the first and second toes, it divides into two branches, one of which descending to the sole of the foot, joins the external plantar artery, and is named *ramus communicans*, the other runs forwards to supply both sides of the first and the internal side of the second toe.

1. *ARTERIA RECURRENS*, arises from the anterior tibial artery as soon as this vessel has passed through the interosseous space; it then bends upwards through the fibres of the tibialis anticus and peronæus longus muscles, pierces the aponeurosis of the leg, and spreads out into numerous branches on the anterior and external surface of the head of the tibia; several branches pass to the adipose substance behind the ligamentum patellæ, others ascend along the fibular margin of this

ligament and anastomose with the inferior external articular artery.

2. RAMI MUSCULARES are very numerous ; they arise from either side of the anterior tibial artery, close to one another, and are distributed to the muscles on each side ; some of these branches pierce the aponeurosis of the leg, and are distributed to the integuments ; others pass through the interosseous ligament, and anastomose with the posterior tibial and peronæal arteries.

3. ARTERIA MALLEOLARIS INTERNA, arises about two inches, sometimes less, above the ankle-joint, it passes behind the tendon of the tibialis anticus, and spreads its branches over the internal malleolus ; some of these anastomose with small branches of the posterior tibial artery ; others enter the bone, and some descend to the synovial membrane.

4. ARTERIA MALLEOLARIS EXTERNA, arises in general opposite the last described artery, and runs towards the external ankle close to the bone ; this artery in general anastomoses with the anterior peronæal, which comes through the interosseous space a little above the ankle. The external malleolar sends several branches to the inferior extremity of the tibia and fibula, and to their connecting ligaments. This artery terminates on the external malleolus by dividing into several branches, some of which communicate with the posterior peronæal artery, and others descend along the outer part of the tarsus, and are lost in the integuments and muscles in that situation. The malleolar arteries are uncertain as to size, and even as to existence.



As the anterior tibial artery is passing over the ankle-joint, it gives off several branches to the synovial membrane and to the surrounding cellular tissue. The remainder of the anterior tibial artery is called by some writers the *pedial artery*.

5. ARTERIA TARSI, arises from the anterior tibial artery as that vessel is passing over the os naviculare; the tarsal artery then runs transversely outwards, distributing its branches to the extensor digitorum brevis, to the different bones of the tarsus, and to the synovial membranes which connect them to each other; at the fibular side of the tarsus it turns beneath the tendon of the peronæus brevis and terminates in the muscles of the little toe, and in inosculations with the plantar arteries.

6. ARTERIA METATARSI, arises from the anterior tibial artery a little beyond the last described branch; it passes outwards over the heads of the metatarsal bones, supplying their articulations; from the anterior part of the arch, which this artery forms, three or four long branches proceed along the three external interosseous spaces; these arteries supply the interosseous muscles, and communicate with the perforating and with the digital branches of the external plantar artery. Previous to the anterior tibial artery dividing into its terminating branches in the first interosseous space, it sends one or two long branches to the upper surface of the great toe; these supply the integuments and extensor tendons of this toe, and run along either side of it to the last phalanx.

7. RAMUS COMMUNICANS. From the division of

the anterior tibial artery this short branch passes directly through the interosseous space, and joins the terminating branch of the external plantar artery.

8. *ARTERIA POLLICIS* passes forwards to the cleft between the first and second toes, and divides into two branches, one of which passes inwards between the tendon of the flexor pollicis and the bone, and then runs along the internal side of the great toe, to its last phalanx; the other branch subdivides into two arteries to supply the opposed sides of the first and second toes.

The anterior tibial artery is liable to be wounded on the instep, or a little above the ankle-joint; in either of these situations it may be exposed and tied in the living subject; this artery may also require to be tied in the leg in case of wound or aneurism. To tie this vessel above the ankle-joint we should flex the foot, in order to relax the extensor tendons; an incision about two inches and a half long should be made through the integuments in the course of the artery, which may be ascertained by feeling its pulsation, or by observing the line of the tendon of the extensor pollicis proprius, on the fibular side of which it here lies; the fascia of the leg should be next divided to the same extent; it may in some cases be advisable to make a short transverse division of this fascia: the tendon on each side should then be held aside with a broad curved retractor, and on removing a little cellular membrane the nerve is brought into view, beneath which lies the artery with its *venæ comites*; these are

to be separated from the artery, and the aneurism needle passed round the latter; the nerve in this situation is usually superficial to the artery, it is however uncertain.

In case of a wound of this artery on the instep the vessel can be easily tied, either by enlarging the wound, or by making a fresh incision on the fibular side of the tendon of the extensor pollicis proprius muscle, taking care to avoid the first or the internal tendon of the extensor digitorum brevis. In consequence of the free communication between the anterior and posterior tibial arteries, it will be prudent in case of wound in this situation to tie both ends of the divided vessel.

The anterior tibial artery in some subjects is very small, so that when it has arrived near the ankle it is nearly exhausted; in such cases I have always found that the anterior peronæal artery is proportionably large, and joins the anterior tibial near the ankle, and thus compensates for the unusual small size of this vessel. The anterior tibial is sometimes wanting, even in the upper part of the leg, its place being then supplied by perforating branches from the posterior tibial artery.

## GENERAL OBSERVATIONS.

THE student having concluded the dissection of the arteries of the pelvis and lower extremity, may reflect on the various inosculations that exist between these vessels in the different regions of the groin, thigh, popliteal space, leg, and foot; and as in the upper extremity he could trace one chain of anastomoses from the neck to the hand, in like manner, in the lower extremity a free vascular communication exists from the pelvis to the foot; so that if the main artery of the limb be obstructed in any part of its course, numerous opportunities are immediately presented for the establishment of collateral circulation.

There is a striking analogy in the course and distribution of the blood-vessels in the superior and inferior extremities. In both a large trunk pursues an undivided course for a considerable length of way, giving off comparatively but few branches, except in particular situations; thus around the shoulder and in the axilla there are arteries of considerable size; so from the groin, around the hip, the femoral artery sends off its largest branches; in both regions these vessels hold numerous communications with each other, and with arteries from different and distant sources. The *arteria anastomotica* from the femoral, resembles that from the brachial in its course and in its communications. The recurrent arteries around the elbow have some resemblance to the articular arteries of the

knee-joint; and the three divisions of the popliteal artery are essentially the same as the radial, ulnar, and interosseous branches of the brachial artery. In the foot, as in the hand, the principal branches supply the flexors, and comparatively few are distributed to the extensors. In the sole of the foot and on the toes, as in the hand and fingers, the arterial vessels have a similarly free communication, their anastomoses forming arches; these, however, are not so numerous in the foot as in the hand; in the latter there are two distinct arterial arches, a superficial and a deep;\* in the foot there is but one, and this placed at a great depth from the surface, although there is a considerable quantity of muscular substance in this region. The difference in the number of vessels then in the foot and hand is not proportioned to the quantity of muscular substance to be supplied, but appears to depend rather on a difference in their function, the muscles of the foot being always very limited in their contractile powers, while those of the hand are capable of performing a greater number of motions, and those more complicated and delicate than any other muscles in the body.

All the anastomoses between the femoral and other arteries may be naturally divided, as Scarpa observes, into two orders, the one including the inosculations which take place between the arteries of the parietes of the abdomen and thorax, and of the inside of the pelvis, and branches of the femoral artery; and the

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\* See page 182.

other including those which occur between the femoral and profunda arteries along the thigh, and around the knee.

The first order of anastomoses must be of essential service in conveying blood to the femoral artery in case the external or common iliac has been obliterated. The second will serve to convey blood to the limb when the femoral artery has been obstructed in any part of its course.

Whenever the external iliac artery has been obliterated, blood will be conveyed to the lower extremity from different sources, namely, the circumflexa ilii, the superficial and deep epigastric arteries; the communications of these with the internal mammary, intercostal and lumbar arteries, will assist in supplying the femoral; the obturator, glutæal, sciatic, and pudic, through their communications with the circumflex branches of the profunda, must also be of essential service in conveying blood to the arteries of the thigh. These last named inosculation are the principal sources of supply in case the femoral artery has been tied above the origin of the profunda.

Whenever the femoral, or more properly the crural artery, shall have been obliterated below the origin of the profunda, then the supply of blood to the thigh and leg must depend on the second order of anastomoses; these are so obvious, and have been so frequently alluded to before, that it is unnecessary now to describe them particularly: posteriorly the perforating arteries communicate, not only with each other from the upper to the lower part of the thigh, but also superiorly with the



arteries of the pelvis, and inferiorly with the popliteal artery; anteriorly the descending branches of the external circumflex artery inosculate with the articular arteries, and there are numerous communications of the small branches of the femoral artery in the integuments and muscles, on the periosteum, and in the substance of the bone, with each other, and with branches of the profunda, and with the articular branches of the popliteal artery.

The number of minute anastomoses along the limb is totally incalculable; these in addition to the more obvious inosculation between the larger branches, are fully sufficient to convey blood to the popliteal artery, and so to the arteries of the leg and foot, in case disease or accident should cause any impediment to the flow of blood through the common or external iliac or through the femoral artery.

THE END.









